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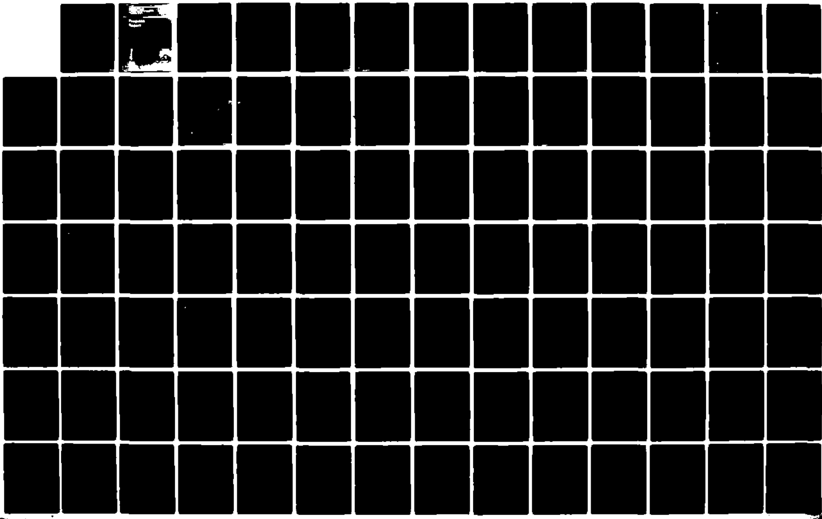

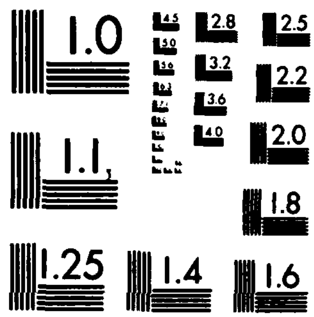

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Report discusses the studies of two containment sites; Clinton Harbor and Black Ledge (Groton) North in Connecticut. Detailed investigations at Clinton Harbor and Black Ledge have been made to provide specific information applicable to the Connecticut-New York area for comparison with existing facilities nation - wide. Clinton Harbor would be a Marsh creation project while Black Ledge would be a shallow island creation project. This report is a compilation of the various site screenings and the detailed investigations of Clinton Harbor and Black Ledge.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF

The Long Island Sound Dredged Material Containment Study was authorized by Congress in May 1977. The study is being conducted by the U.S. Army Corps of Engineers, New England Division, to determine the feasibility of implementing dredged material containment facilities in the Long Island Sound area as an option for the disposal of dredged materials for the region.

From the beginning, we have made a concerted effort to involve the broadest cross-section of the public, as possible, in this study. Through our previous publications and workshops, we have not only kept the public informed of our efforts but have also gained valuable information that has been incorporated into our work.

This document is a comprehensive report of our progress to date on the Long Island Sound Dredged Material Containment Study. It is designed to serve as a reference source for those people interested in Long Island Sound, the concept of dredged material containment facilities and our study.

We hope you will find this information useful and encourage you to participate in our public workshops that will be conducted in the study area during the Spring of 1983. As soon as dates and locations have been established, we will inform you through an additional mailing.

If you have any further questions about this study, you may call my study manager, Mr. Richard Quinn, at (617) 647-8216. For information on the Corps' many other roles in the management of New England's water resources, please call our Public Affairs Office at (617) 647-8778.

Carl B. Sciple
Colonel, Corps of Engineers
Division Engineer

EXECUTIVE SUMMARY

The Long Island Sound Dredged Material Containment Study was authorized by Congress in May 1977. The Progress Report summarizes the work accomplished to date in determining the feasibility of dredged material containment facilities in Long Island Sound. Numerous sites along the Connecticut and New York coast have been considered in varying degrees.

Studies of two sites, Clinton Harbor and Black Ledge (Groton), both in Connecticut, have been advanced because of local recommendation to investigate these sites. Although other sites still under consideration may yet prove to be better containment facility sites, detailed investigations at Clinton Harbor and Black Ledge have been made to provide specific information applicable to the Connecticut-New York area for comparison with existing facilities nationwide. These sites represent two very different types of containment facilities; Clinton Harbor would be a marsh creation project while Black Ledge would be a shallow island creation project.

This report is a compilation of the various site screenings and the detailed investigations of Clinton Harbor and Black Ledge. It does not recommend any site for construction because, at the present time, the entire range of alternatives have not yet been addressed.

The sites which are currently being considered are:

* Clinton Harbor, Clinton & Madison, CT
* Black Ledge, Groton, CT
* Sherwood Island Borrow Hole, Westport, CT
* Yellow Mill Channel, Bridgeport, CT
* Penfield Shoals/Reefs, Fairfield, CT
* Milford Harbor Jetty, Milford, CT
* Gold Star Bridge, New London, CT
* Menunketesuck Island, Westbrook, CT
* Guilford Harbor Disposal Area, Guilford, CT
* Housatonic River Breakwater, Milford, CT
* I-95 Interchange, West Haven, CT
* Flushing Bay, New York, NY
* Mamaroneck Harbor, Rye & Mamaroneck, NY
* Falkner/Goose Island, Guilford, CT
* Duck Island Roads, Clinton, CT
* Stratford Shoals, Stratford, CT

Sites which, after studying, have been eliminated for environmental reasons are:

* Bayview Park, New Haven, CT
* East Shore Park, New Haven, CT
* Fayerweather Island, Bridgeport, CT
* Seaside Park, Bridgeport, CT

* Morris Cove, New Haven, CT

Sites eliminated due to excessive costs are:

* Twotree Island, Waterford, CT
* State Maritime College (Throgs Neck Bridge), New York, NY

Multi-disciplinary environmental surveys were conducted at both CLinton Harbor and Black Ledge. The objectives of the survey were to identify and document the physical and ecological conditions of the area, identify and classify habitat types, and determine the habitat value and environmental acceptability of constructing a DMCF.

The Clinton Harbor work was done in 5 sections:

* Collection of physical oceanographic data.
* Tidal hydrodynamic modeling.
* Sediment-water interface photography and habitat evaluation.
* Survey of benthic macrofauna, finfish, shellfish, algae and marsh plants.
* Marsh-creation feasibility evaluation.

The hydrodynamic simulation indicated that tidal current patterns and flushing characteristics of the harbor do not appear to be detrimentally altered by the proposed development. The most significant effect of DMCF construction would be an increase in tidal velocities in the outer harbor where such changes could produce signficantly increased sediment transport.

Within the area of the outer harbor (DMCF site), sediments were determined to be unstable and in a state of chronic minor and periodic major resuspension. This unstable bottom does not allow the establishment of complex, balanced biological communities. It appears that the frequency of physical disturbance in this area is sufficient to limit its value as a habitat. The area was determined to have high potential for biological enhancement through the establishment of a marsh on the deposited materials.

This enhancement would occur in several areas, including:

(1) the marsh proper, incorporation of over 60 new acres of *Spartina alterniflora* (salt marsh grass) habitat;

(2) nearly 30 acres of shallow subtidal inlet-type habitat; and

(3) nearly 5000 linear feet of rock breakwater providing hard bottom suitable for colonization by a diverse macrofaunal community.

The investigations undertaken to date indicate no serious adverse impacts from the proposed DMCF construction and have identified several projected benefits.

For the Black Ledge site, a sampling plan comprising diver-operated suction sampling and traditional grab sampling was designed. A REMOTS (sediment-water-interface) survey was conducted at the deeper stations to the south and west of the shoal. The diver sampling of rocky bottoms was conducted along 3 transects and samples taken at 5', 10', 20' and 30' along each.

The findings of this survey indicate that periodic physical disturbance in the area is apparently sufficient to prevent the establishment of communities with higher successional states. The frequency of disturbance appears to be greater in areas of less than 30' depth; however, even the deeper stations sampled exhibited evidence of a history of recurring periodic disturbance.

On Black Ledge, wind and tidally driven currents and waves create a hydrodynamic regime which limits the fauna to those species adapted to a hard-bottom, high-energy habitat. The most conspicuous feature on the ledge was a dense and virtually uninterrupted covering of mussels at least one layer thick on all available rock surfaces.

From November 1981 through January 1982, a preliminary subsurface exploration program consisting of machine probings and borings was performed in order to define foundation conditions. A total of 11 probes and 3 borings were performed at Clinton Harbor and 22 probes and 5 borings were performed at Black Ledge. Overburden samples recovered from the exploration program were tested at the New England Division Materials and Water Quality Laboratory for the following: gradation, both by sieve and hydrometer; Atterberg limits; organic content; water content; and specific gravity. The bedrock samples from Black Ledge were tested for specific gravity, absorption and unconfined compressive strength.

At Clinton Harbor the offshore area is generally flat, with boulders providing some relief. Minimum offshore elevation at the site is approximately -8 feet NGVD. Soil conditions in the foundation area consist of surficial deposits of granular soil overlying very soft organic silt to undetermined depth. The granular soil is predominantly loose, medium to fine sand with shell fragments interbedded with deposits of loose to moderately-compact, silty sand and moderately-compact gravelly sand. The depth of sand deposits varies from 7 to 30 feet within the prototype dike alignment.

The offshore area at Black Ledge is generally flat, with numerous areas of resistant bedrock, such as Black Ledge, providing relief. Minimum offshore elevation at the sites is approximately -14 feet NGVD. Soil conditions consist of a surficial deposit of very loose, silty sand with shell fragments and plant matter ranging in depths from 1 to 6

feet. In general, the surficial deposits are underlain by a strata of moderately compact, granular soil ranging from fine sand to silty, gravelly sand. Along the westerly half of the area, the granular soil overlies very dense, silty, gravelly sand or bedrock. Bedrock was encountered in 2 borings at depths of 14 and 10 feet below ground surface. In the eastern half, moderately-compact fine sand and silty, gravelly sand overlies moderately-compact inorganic silt.

Due to reasonably poor foundation conditions at both Clinton and Black Ledge, the originally proposed alignments were altered to avoid soft soil and deep water. The Clinton Harbor prototype facility has a crest elevation 6 feet above mean low water (MLW) (+4 NGVD), a 12-foot top width and side slopes 1 vertical on 2.5 horizontal. Riprap will be placed on the ocean side of the dike and a gravel blanket on the containment side slope.

The Black Ledge prototype design has a crest elevation of +13.5 MLW (+12 NGVD), a 14.5-foot top width and side slopes of 1 vertical to 1.5 horizontal. To protect the dike against overtopping, the slope protection (1000-2000 lbs armor stone) will be placed over the crest and down the inside slope to an elevation of -6 feet MLW.

The results of an analysis of social and economic impacts associated with the construction of containment structures at five potential shoreline locations in Long Island Sound have also been included. The sites evaluated are Clinton Harbor, New Haven Harbor, Fayerweather Island and Yellow Mill Channel in Bridgeport Harbor, Black Ledge at Groton and Twotree Island at Waterford.

Impacts during the construction period were addressed, as well as long term impacts subsequent to completion of the facility and adoption of eventual use. Effects on the following social and economic factors were addressed: life, health, safety, community services and facilities, recreational opportunities, employment, land values, transportation, and commercial and industrial activity. Both short and long term impacts were considered. As expected, potential impacts vary considerably among the five sites.

Dredging projections, from the Programmatic EIS for the Disposal of Dredged Materials in the Long Island Sound Region, reflect a range of possible future port conditions in Long Island Sound:

- Minimum Growth, Minimum Change Scenario
- Most Probable Future Scenario
- Maximum Growth, Maximum Change Scenario

Based on the Most Probable Future Scenario, the projected Federal maintenance dredging would be over 20 MCY in Connecticut and about 3.5 MCY in New York for the 50-year period 1985 - 2035. The Most Probable Future Scenario indicates that for that same period non-Corps dredging by permit

would be approximately 20 MCY in Connecticut and approximately 6.6 MCY in New York. Federal Improvement dredging is uncertain at this time due to the proposed changes in policy concerning small harbors.

The communities along the north shore of Long Island, in Nassau and Suffolk Counties, have indicated that dredged material disposal is not a problem in their harbors. These areas will no longer by considered as possible sites for containment facilities. A potential containment facility in New York City is currently being investigated by New York District, eliminating the need for New England Division to study it further. Our study area has been narrowed down to include the Connecticut coastline and the Westchester County, New York coastline only.

LONG ISLAND SOUND

DREDGED MATERIAL CONTAINMENT

PROGRESS REPORT

LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY

PROGESS REPORT

Chapter I

INTRODUCTION

TABLES

PLATES

INTRODUCTION

Long Island Sound has been subject to disposal of dredged material and other urban-industrial wastes for more than 100 years. Management of disposal activities in the Sound began in 1888 when the Port Supervisors Act prohibited disposal outside of designated areas. Since then 20 sites have been put in service for disposal of dredged material. As a result of increased public concern over the potential for long term environmental effects of disposal operations, only three of these historic sites are still in use - Central Long Island Sound, Cornfield Shoals and New London. A fourth site, designated Western Long Island Sound III has recently been approved for interim use. It is imperative that future dredged material management plans be designed to further centralize and minimize any potential effects of dredged material disposal in the Sound.

STUDY AUTHORITY

The authority to conduct a study to determine the feasibility of creating Dredged Material Containment Facilities (DMCF) within Long Island Sound is contained in a resolution of the Committee on Public Works and Transportation, U.S. House of Representatives adopted 10 May 1977:

> Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Land and Water Resources of the New England-New York Region, published as Senate Document Numbered 14, Eighty-fifth Congress, First Session, and other pertinent reports, with a view to determining the feasibility and impacts of the treatment and use of the dredged materials to result from the continued maintenance and anticipated improvements of Long Island Sound harbors, as well as from any newly created Federal harbors, to build artificial islands in Long Island Sound for recreation, conservation, marsh building, development, and other purposes. The study should also consider the utilization of dredged materials from projects other than Federal (i.e., State community, and private), and the feasibility and acceptability of utilizing solid wastes other than dredged materials for island building.

A reconnaissance report (January 1979) was prepared by this office. At that time the study area was limited to the Connecticut portions of Long Island Sound. The submittal letter accompanying the reconnaissance report to the Office of the Chief of Engineers requested clarification on whether to include the New York portion of Long Island Sound in this overall study. In their approval of the reconnaissance report, dated 17 May 1979, the Chief of Engineers stated that "the report recognized the potential impact of the study on New York. It appears that the study area

should include the New York shore if only to more clearly define the impact of disposal measures on New York. Coordination with the North Atlantic Division, Corps of Engineers, should be carried out during the course of the investigations."

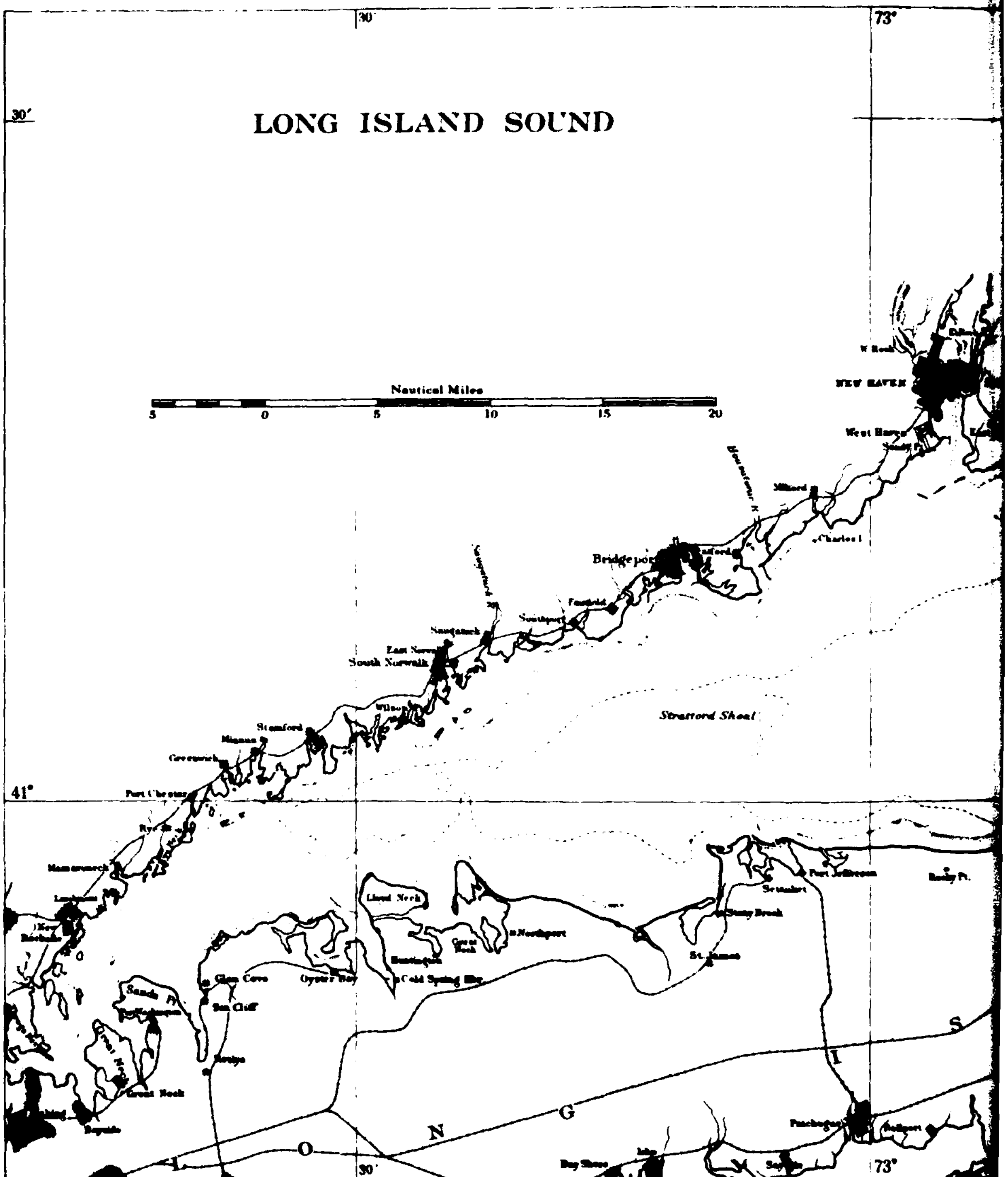
STUDY AREA

Long Island Sound is one of the nation's unique and irreplaceable natural resources. It has over 1300 square miles of water surface area and is an almost fully enclosed arm of the ocean bordered by nearly 600 miles of coastline (see Plate I-1). The Sound is a maximum length of 113 miles and a 21 mile width. About seventy-five rivers and streams of various length drain the 16,000 square mile area surrounding Long Island Sound with the Connecticut and Thames Rivers as the major contributors. Within the water of the Sound there are about 125 islands. The study region includes the area within Long Island Sound and Fishers Island Sound extending from Throgs Neck Bridge in New York eastward to the Connecticut-Rhode Island State line. Long Island Sound exhibits estuarine characteristics in its western and central parts and embayment characteristics in its eastern third. Depths vary greatly throughout the Sound averaging 80 feet with a maximum depth of 320 feet. Movement of water within a major estuary such as Long Island Sound is complex due to the effects of tides and freshwater inflow conditions.

REPORT OBJECTIVE

The purpose of this report is to present all study results completed to date. After reviewing this document it will be apparent that considerably more study effort was focused on the Clinton-Hammonasset area and Black Ledge - Groton than any other sites. Studies of these two sites were advanced because of local recommendations to investigate these sites. While other sites presently under consideration might prove to be more acceptable sites for use as containment facilities, detailed investigations at Clinton and Black Ledge were initiated so that this office would have some in-depth information with which to compare DMCF's in the Connecticut-New York region to the many previously studied, and built, facilities nationwide. A planned and properly engineered containment facility has never been constructed in areas under the jurisdiction of the New York District or the New England Division. Additionally the Clinton and Black Ledge sites represent two distinct types of containment facility usages - a marsh creation project, and a shallow water island creation project.

The studies done at Clinton and Black Ledge would approximate the level of detail that this office would expend on analyzing any site which appears to be suitable as a dredged material containment facility. The other environmental studies detailed in the report for the remaining sites in Connecticut and New York represent only an initial data collection or base line inventory from which comparisons may be made. Based upon evaluations made at these sites and the general acceptance of each site,


LONG ISLAND SOUND
Nautical Miles
5
0
5
10
15
20
30'
73°
41°
NEW HAVEN
West Haven
Milford
Bridgeport
Fairfield
Southport
Saugatuck
East Norwalk
South Norwalk
Stamford
Greenwich
Port Chester
Mamaroneck
Stratford Shoal
Lloyd Neck
Northport
Huntington
Cold Spring Hbr
Oyster Bay
Glen Cove
Sea Cliff
Great Neck
Bayside
Port Jefferson
Setauket
Stony Brook
St. James
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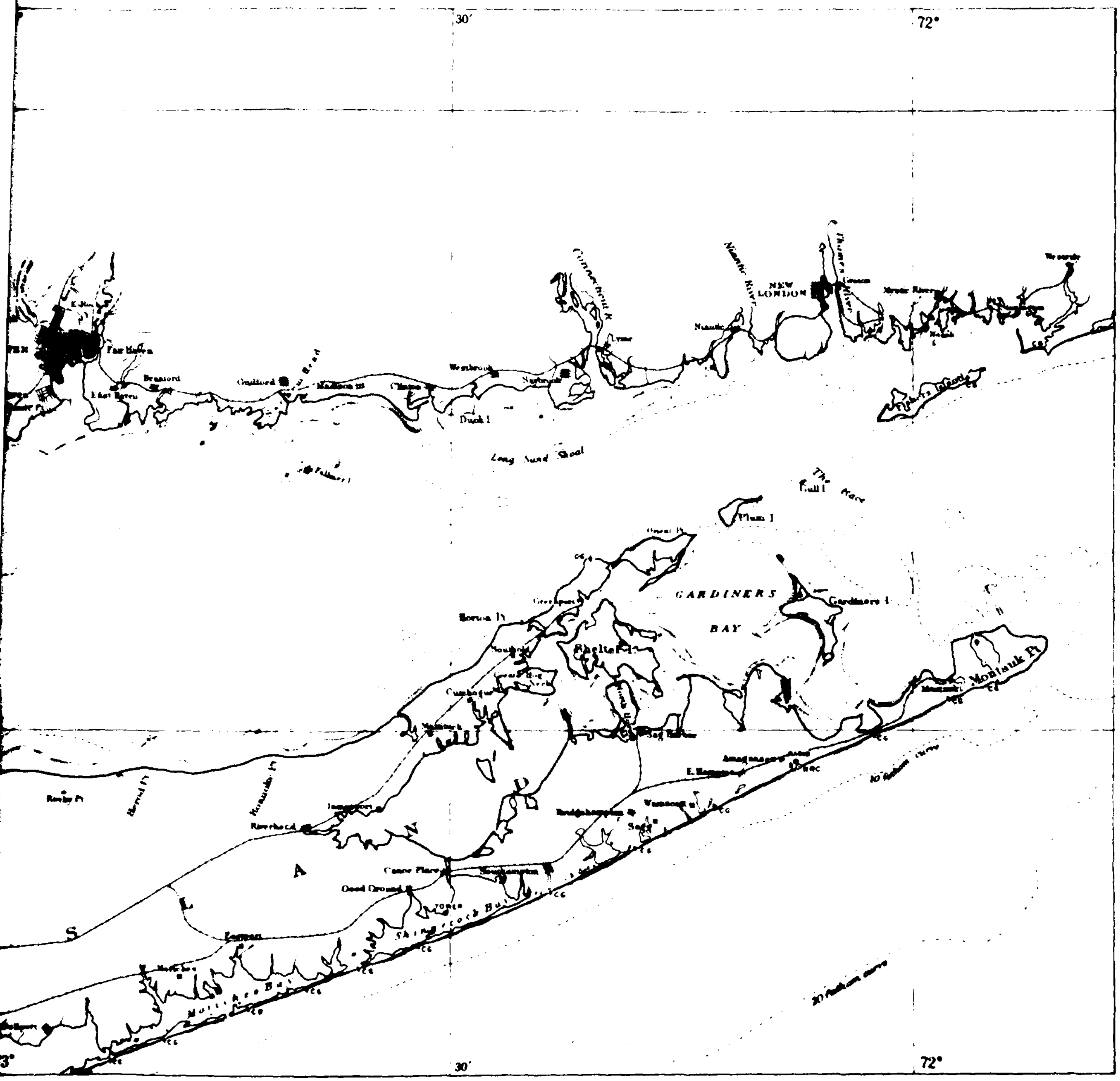

30'
72°
NEW LONDON
Fair Haven
Guilford
Madison
Westbrook
Saybrook
Lyme
Niantic
Duck I.
Long Sand Shoal
The Race
Gull I.
Plum I.
GARDINERS
BAY
Gardiners I.
Shelter I.
Sag Harbor
Montauk Pt.
Southampton
Riverhead
A
L
S
N
D
10 fathom curve
20 fathom curve
30'
72°

PLATE I-1

2

detailed investigations may than be initiated. The final draft feasibility report on dredged material containment facilities for Long Island Sound is currently scheduled for submission in September 1984. Recommended alternatives will be suggested in that report. This report does not recommend any site for construction at the present time because existing regulations do not allow individual projects to be considered before the entire range of alternatives are addressed.

PRIOR REPORTS

Reconnaissance Report

Scope - The January 1979 Reconnaissance Report outlined the purpose and scope of the study and provided preliminary information on dredged material volumes, previous and existing disposal locations and cost estimates and comparisons. The preliminary siting analysis, based on macro-level environmental resource and land use data, proved to be too general for precise recommendations on potential sites. This analysis included shoreline, nearshore and deep water locations.

The scope of this report was limited to include containment of material dredged from Connecticut harbors only. Dredging in New York harbors was not considered. Dredged material from two types of channel maintenance and construction projects was considered.

1. Federal projects authorized by Congress; and

2. Other projects allowed under federal permit.

Projection of future dredged material quantities for the period from 1985-2035 were made based on historical data.

Two approaches were used in the preliminary cost analysis:

1. A single facility to receive all material from 1985-2035; and

2. Three facilities, one located in each of the three coastal areas.

Three types of sites were assumed:

1. Shoreline extensions in water depths of up to 6 feet mean low water (mlw);

2. Nearshore islands in water depths of up to 18 feet mlw; and

3. Offshore islands in water depths of up to 54 feet mlw.

Using average water depths for each of the three zones and an assumed final fill elevation based on structural design criteria, the comparative size and cost of the structures required were estimated.

Contents - At present, there are 27 federally authorized harbor projects in Connecticut. In recent years, the Corps of Engineers maintenance dredging program in Connecticut has been much more active than the improvement program, particularly in the central coastal area. The federal portion of the dredged material expected to be generated in Connecticut during the 50 year period from 1985-2035 is estimated to be about 39 MCY. Over 70 percent of this volume will result from maintenance projects and 64 percent will originate in the central coastal area. Non-Corps dredging has greatly exceeded Corps dredging in recent years and as in the case of federal projects, non-Corps dredging activity is highest in the central coastal area. The annual averages computed for each coastal area since 1968 have been used to estimate the non-Corps dredging activity for the 50 year period from 1985-2035 at about 20 MCY. More than half of this volume will originate in the central area. Disposal of the dredged material has been in open water or on land including the use of dredged material for fill.

In view of the cost differential and the necessity of replacing a sheet pile structure every 25-30 years, the sheet pile alternative was dropped from further cost comparisons. However, it may be advantageous under certain circumstances to incorporate sheet pile segments into a rock-fill dike to provide ship access or where space is limited. In addition to being the most economical design, the rock-fill dike offers advantages of indefinite life, favorable appearance, ease of construction, minimal maintenance, and a rough sloping surface that provides attractive habitat for many forms of marine life. A comparision of the first cost per linear foot of wall is as follows:

	SHORELINE EXTENSION	NEARSHORE ISLAND	OFFSHORE ISLAND
Rock-fill dike	$1,100	$2,400	$6,900
Sheet pile cofferdam	$3,200	$4,700	$8,300

To illustrate the range of possibilities, four alternatives for providing 50 years of containment capacity for Connecticut harbors were investigated. The present worth of these four alternatives is compared in Table I-1 , using the then prevailing Federal interest rate of 6-7/8 percent. As expected, the shoreline location is the most economical in all cases. Although more accessible, the smaller capacity, regionally sited facilities are more expensive than the centrally sited, higher capacity facilities.

For the most part the land created from the dredged material of Long Island Sound would be best suited for passive land uses, such as recreation, for which foundation soils requiring high bearing capacity or strength are not required. There are no structural barriers to building on these sites, only the need to combine proven methods with innovative design and plentiful financial resources. Costly foundation engineering will be required for structure foundation support.

TABLE I-1

PRESENT WORTH OF ROCK DIKE ALTERNATIVES FOR PROVIDING 50-YEAR CAPACITY
1978 DOLLARS

ALTERNATIVES	DESIGN LOCATION	PRESENT WORTH ($ million)
1. 59 MCY facility now	shoreline	24.5
	nearshore	60.2
	offshore	131.5
2. 30 MCY facility now, another in 25 years	shoreline	20.9
	nearshore	51.3
	offshore	112.2
3. 12 MCY facility now in both west and east, 37 MCY facility now in central	shoreline	41.4
	nearshore	102.3
	offshore	224.0
4. 3-12 MCY facilities now, another 12 MCY in central area in 17 years, and a third 12 MCY in 34 years	shoreline	37.8
	nearshore	93.8
	offshore	205.4

SOURCE: Reconnaissance Report, January 1979.

Dredging costs are extremely difficult to estimate due to variables in sediment consistency, depth of material dredged, distances covered, fuel costs, volume of material to be dredged, time requirements, and the availability of dredging contractors. However, for dredging transport by barge for a distance of about 30 miles, a figure in 1978 dollars of $3-5 per cubic yard would be reasonable. An increase in haul distance from about 15 miles to about 50 miles would result in an increase in project cost of 15-20 percent.

The siting analysis began with the collection and review of data to be used to initially identify potential sites in the shoreline and nearshore/offshore design locations. The macro-level environmental and land use data were synthesized on a series of working base maps of Long Island Sound and the Connecticut Coast. The process of identifying potential land/island creation sites began with a review of all past and present open water dumping grounds, and the island creation sites suggested in 1974 by McAleer.[1] The biological resource data for Long Island Sound provided an overall environmental framework for initial site review, enabling fisheries, wetlands, etc. to be plotted and considered, albeit at a gross level (except where detailed data were available such as in the case of oyster grounds). Another important aspect of preliminary siting was the various wind, tide, current, and wave energy regimes in the Sound. In conjunction with preliminary siting decisions based on the natural characteristics of the Sound, additional judgements were made on the basis of existing man-made characteristics of the Connecticut coastal zone, as well as plans for future land uses. The site review was geared to large volume, long-life facilities. The potential containment facility locations identified were offered as a base from which a more rigorous site selection process could be developed.

Three possible shoreline extension sites were initially identified:

1. Bridgeport Harbor between the west breakwater and Tongue Point;

2. The tidal flat near Long Wharf in New Haven Harbor; and

3. The tidal flat adjacent to East Shore Park in New Haven Harbor.

Upon closer examinations each of these sites was determined to be in proximity to shellfish habitats considered critical by the State of Connecticut. Several nearshore and offshore sites were considered. However, due to the generally rich, diverse and productive habitat of sandbars, shoals and rock ledges, it is difficult to find an area large

[1]McAleer, John, "Artificial Islands and Platforms in Long Island Sound," prepared for the Long Island Sound Regional Study, New England River Basins Commission, New Haven, Connecticut and Boston, Massachusetts, June 1974.

enough to build a containment facility where the marine life will not be affected in some way. The most feasible may be those areas previously altered through open water disposal activities.

Findings - The Reconnaissance Report focused on the large volume containment alternatives for long term dredged material disposal in Long Island Sound. It concluded that the selected plan will most likely incorporate several disposal alternatives, and will not depend exclusively on either contained or open water disposal. The continued investigation of the proper role for containment alternatives can benefit from these findings.

1. The sediments and soils in Connecticut's ports and waterways are predominantly fine grained sands and organic silts.

2. In order to convert dredged material islands to some active use requiring even low soil bearing capacity, innovative and costly foundation engineering will be needed.

3. The possibility of small volume usable land/island creation projects cannot be evaluated without detailed knowledge of the physical and chemical properties of the sediments and soils in the harbors and potential disposal locations.

4. The fine grained sediments characteristic of most Connecticut harbors may be suitable for eventual inland disposal as fill material or sanitary landfill cover or road sanding operations in winter months.

5. A simple rock-fill dike appears to be the least expensive design option appropriate for Long Island Sound.

6. It would be less expensive to build a 30 MCY facility and then proceed to build another 30 MCY facility 25 years later, rather than a single 59 MCY facility initially.

7. Offshore locations appear to be most feasible for large sites.

8. The largest facility examined in the Reconnaissance Report would remove about 680 acres of Long Island Sound bottom land from the ecosystem which is considerably less than the 2,500 acres now encompassed by the 3 active open water dumping sites.

9. Many technical, environmental, economic, and social tradeoffs will have to be made if alternatives to open water disposal in Long Island Sound are to be found.

10. A truly meaningful analysis of potential containment sites cannot be conducted outside the perspective of a comprehensive dredged material management plan for Long Island Sound.

11. The revised New York/Connecticut Interim Plan has been completed by NERBC.

12. At the present time, no waste disposal activities other than for dredged material are permitted in Long Island Sound. The desirability and economic feasibility of depositing these waste materials in a dredged material containment facility are unknown, but questionable, at this time.

The Reconnaissance Report was limited to the Connecticut portions of Long Island Sound. The problems associated with the disposal of dredged material in Long Island Sound are not isolated in the Connecticut waters; any disposal operations impact upon both Connecticut and New York. The feasibility of locating containment facilities in New York waters was not considered.

The report focused on large regional facilities and did not sufficiently analyze small volume shoreline extensions facilities.

18-21 May 1981 Workshop Digest

The purpose of the Workshop Digest is to provide workshop attendees and other interested individuals a summary of the topics discussed and the issues and questions raised at the four workshops held in May 1981.

This report includes an outline and explanation of the workshop format, the purpose of these meetings, and a summary of each session and the issues, concerns, and questions of the participants. Nine official statements and written communications received from public officials are included in this report. The public information program is explained and samples of all the press releases, announcements and articles publicizing the workshops are shown followed by samples of the media coverage generated by these workshops. Also shown are the text of the presentation, a list of the workshop attendees, and written communication received from State officials, local leaders and concerned citizens.

Market User Survey

Scope - This report summarizes the activities in 50 ports and harbors located on or adjacent to Long Island Sound. The demand for harbor improvements will aid in projecting future dredged material volumes in Long Island Sound. Projections of port activities included in this market user survey are based on recent trends, planned port development, and anticipated changes in shoreline activities, including possible conversion of electrical generating plants from oil to coal.

Contents - Information developed for each of the 50 ports includes the following:

1) existing port uses, both commercial and recreational;

2) projection of future activities based upon historical and continuous trends, development potential and existing development plans;

3) a "no-action" scenario detailing potential economic impacts if the dredged material disposal problem is not solved.

4) potential uses of the new land created are addressed in a preliminary manner based on present and anticipated future demand for shoreline facilities and water transport.

A straight-forward approach was used to identify and obtain relevant information. Existing up-to-date literature sources were utilized but the largest and most significant sources were individuals knowledgeable of conditions in each of the subject ports. Direct, face-to-face interviews and telephone interviews were conducted with major channel users; local port authorities; Chambers of Commerce; State, regional and local planning agencies; and local harbormasters and municipal yacht club officials. Discussions were also held with various State and Federal agencies and individual electrical utilities regarding the oil-to-coal conversion issue.

Findings - The information obtained and documented in the Market User Survey allows some general statements to be made.

The generally high population densities of shoreline communities contributes to the importance of the Sound as an avenue for commercial shipping as well as the basis for, and regional variations in, demand for high quality water based recreation. Connecticut's modest population and employment growth is due to the losses in the NYC metropolitan area. Connecticut's high per capita income and ability to maintain its manufacturing base and increases in nonmanufacturing employment appears to provide support for continued modest growth. A significant and growing middle income populace enjoys recreational benefits through boating on LIS.

In the near term (i.e. next 10 years) there is the possibility that several small, old steam electric power plants that have burned coal and were converted to oil to meet the 1970 Clean Air Act requirements may convert back to coal. The conversion to coal situation is quite uncertain. However, four facilities in New Haven Harbor, two in Norwalk Harbor and two on the Housatonic River have tentative plans to convert to coal; if the Bridgeport generating unit converts to coal it could require a coal tonnage of 0.7 - 1.0 million tons/yr. Commercial shipping will continue to provide an important economic base for movement of commodities to and from inland areas.

A need for dredging LIS harbors has been expressed by the majority of the harbor users. Evidence of this problem includes numerous groundings,

routinely waiting for high tide, harbor congestion, and lightering[2] offshore.

Without dredging, many marinas claim a loss of business due to inadequate channel and anchorage basin depths. There is a very strong demand for recreational boating facilities particularly in western LIS. The vast majority of marinas have waiting lists for available slips or moorings. Apparently the increasing costs of fuel have lead to a trend toward sailboats with fixed keels which draw more water than power boats, necessitating deeper and/or more frequently maintained channels and marina areas.

The costs of dredging and disposal can be an important factor in reaching a decision to actually proceed with a local project. Cooperative efforts between marina owners and shipping interests, and coordination with the dredging contractor for a federal project, can reduce dredging costs. Environmental constraints of local disposal site availability are viewed as a significant contribution to increased project costs. Two of these problems are: (1) the distance to an approved regional disposal site, and (2) the lack of suitable available land for disposal.

Community planning authorities are seeking to realize multiple use benefits from their ports and harbors. Rehabilitation of aged facilities to support varieties of commercial and recreational uses is being promoted. Municipal zoning ordinances excluding non-marine commercial and residential developments have been implemented in many harbors. There is a tremendous demand for real estate for non-marine dependent uses. There is a general lack of developable land in the majority of the harbors, and real estate value escalation is putting even available land out of reach of all but high value condominiums.

Social & Economic Impacts Of Prototype
Dredged Material Containment Facilities In Long Island Sound

Scope - The objective of this portion of the study was to analyze social and economic impacts associated with the construction of dredged material containment facilities at six potential locations along the Connecticut shoreline: Fayerweather Island in Black Rock Harbor, Yellow Mill Channel in Bridgeport Harbor, Morris Cove in New Haven Harbor, Clinton Harbor, Twotree Island off Waterford, and Black Ledge at the mouth of New London Harbor. Short term impacts during construction of dikes, filling with dredged material, dewatering, and final capping, contouring and planting have been examined, as well as long term impacts involving final use.

Contents - The analysis includes determination of the economic efficiency of each of the six prototype containment facilities and

[2] Loading and unloading vessels in deep water.

comparison with alternative disposal methods: (1) land disposal, (2) disposal in Long Island Sound, and (3) disposal in the open ocean. Subtasks accomplished include:

- Research of existing literature on containment facilities.
- Preparation of an overview of the Long Island Sound region.
- Determination of potential uses for each facility.
- Determination of primary and secondary short term and long term social and economic impacts.
- Determination of social acceptability of containment facilities in Long Island Sound.
- Economic analysis of the cost efficiency of each proposed containment facility including:
    1. Examination of the most efficient service area for each facility.
    2. Comparison of proposed capacities and dredging needs in the immediate area.
    3. Comparison of the cost/cu yd of dredged material disposal by containment facility, land disposal (1 mi), Long Island Sound disposal (10 mi), and open ocean disposal (100 mi).
    4. Possible economic return through use of land created by containment facilities or alternative disposal methods.

Findings - The impact and cost analyses clearly show:

- Of the proposed prototype dredged material disposal facilities, the use of an old borrow pit in Morris Cove, New Haven Harbor, has the lowest unit cost, equalling that of land disposal, but its 900,000 cubic yard capacity will probably be filled in two or so years. It also has the least significant potential adverse social impacts.
- Yellow Mill Channel compares favorably with Fayerweather Island on a cost basis, in serving Bridgeport Harbor needs. Filling Yellow Mill Channel is a locally popular concept, and would have fewer adverse social impacts, because when completed it could provide additional recreational space in a densely populated urban area, whereas the Fayerweather Island facility would eliminate an area of active shellfishing. However, the Fayerweather Island facility would provide almost three times the capacity of Yellow Mill Channel. Disposal at either facility is more economical than open water disposal of dredged material from Bridgeport Harbor.

Although shown in this economic and social impacts report to be true, the detailed survey report of Bridgeport Harbor shows that open water disposal is the least cost alternative.

- The 24 acre Clinton Harbor containment facility would serve the harbor's operation and maintenance dredging needs for 25 years, with little adverse social impact. Containment facility disposal would be more economical than open water disposal, while at the same time, it would replace local marsh area taken by filling in the past. To accomodate permit dredging and improvement dredging, the larger facility would be required.

- The proposed Twotree Island and Black Ledge man-made island containment facilities would have unit costs higher than either Long Island Sound or open ocean disposal. They would be sizeable structures, each entailing several significant potentially adverse social impacts. On the positive side, construction of either would satisfy dredging disposal needs in northeastern Long Island Sound for 30 years or more, thus satisfying objections to the more economic open water disposal alternatives.

- Nearby land disposal is always the most economic method, if access to the land can be acquired at no cost; dikes and water treatment are not required; and dredging is done hydraulically. Public acceptance of land disposal may be difficult to obtain, even if land is available.

Interim Report: Dredged Material Containment In Long Island Sound (With Special Emphasis On Eastern New York Waters).

Scope - This interim investigation addressed the evaluation of the quantity and quality of material historically dredged along the NY shoreline of LIS, and analysis of historical dredging and disposal trends and formulation of projections for the 50 year period from 1985 to 2035. It also included a discussion of the problems and purposes associated with alternative containment facilities and utilization of the methodology for locating and ranking potential sites on publicly owned land and existing disposal sites bordering LIS within Connecticut and New York. In this report, the study area was redefined as the Connecticut and New York coastline bordering LIS.

Contents - As in the Reconnaisance Report, the historical dredging perspective was based upon the two classes of dredging activities: (1) Corps of Engineers dredging, and (2) dredging performed under federal permit. Historical data on Corps and non-Corps, permitted dredging and disposal was compiled from New York District (NYD) files and summarized. This historical perspective was then used, along with tentative Corps improvement and maintenance plans, and regional plans for water related development, to estimate future dredged material volumes. Where appropriate, comparisons to dredging statistics summarized from the

Reconnaissance Report for Connecticut were made. Information on disposal practices for historical federal and non-federal dredging projects as well as disposal site identification were also given.

The interim analysis focused on opportunities and factors related to small volume shoreline extension containment facilities for LIS. Concerns related to the transport, placement, material consolidation, containment operation and associated environmental impacts were identified. Of special interest was the concept of reusable containment sites and material rehandling, with the desire to maximize economic and/or social benefits from such a facility operation. An analysis of the feasibility of siting shoreline extension containment sites on publicly owned shorefront property and existing shoreline dredged material disposal sites along LIS in New York and Connecticut was the most significant aspect of the Interim Report.

Alternative siting methodologies were reviewed and a preliminary technique consisting of primary and secondary screening (ranking) criteria developed. These criteria included engineering, economic, environmental, social (public health, welfare, acceptability, etc.) and legal/regulatory factors. This methodology was then applied to LIS, but limited to consideration of relatively small volume shoreline extension containment facilities adjacent to publicly owned shoreline.

Findings - The dredged material volume projections were based on various scenarios ranging from minimum growth to maximum growth. The federal portion of the dredged material expected to be generated in the New York vicinity of LIS during the 1985 - 2035 period is estimated to range between 4.2 and 17.2 MCY. Over 70% of this volume will originate in the New York City area. The projected range of non-federal dredging for the same period is 11.1 to 31.1 MCY. Like the federal projects, the projected non-federal dredging activity is highest in the NYC area ranging from 4.7 to 13.3 MCY.

A review of New York District records for 1927-1979 indicates that open water disposal has been used in most federal projects in Westchester Co., NYC and Nassau Co. Upland disposal had been utilized for these areas only before 1950. Between 1961 and 1979, all of the dredged material from federal projects in these areas was disposed of in open water. Suffolk Co. has used upland disposal since 1927 for all federal projects except one in Huntington Harbor in 1935. In contrast to federal dredging projects, the preferred disposal method for permitted non-federal projects since 1959 has been land disposal. This is especially true for Suffolk Co., where over 90% of material dredged since 1959 has been disposed of on land. In contrast, open water disposal has been favored in the NYC area.

Several important factors which determine feasibility of the containment method hinge on the physical and chemical characteristics of dredged material. Existing data indicate high variability in concentrations of heavy metals and organics in Connecticut and New York

harbors. Concentrations tend to be considerably greater in sediments sampled in Connecticut harbors than in those from New York. Data collected in harbor sediments along the North Shore of Long Island indicate, on the average, a progressive increase in the percentage of coarser material in sediments sampled from western to eastern Long Island. The proper sizing (surface area vs. depth requirements) of a containment facility depends upon the sediment particle size distribution and settling velocities. The physical characteristics also determine containment dewatering effluent characteristics and associated environmental impacts. Both physical and chemical characteristics determine the potential, if any, for rehandling and marketing dredged material.

The preliminary siting methodology focused on locating small volume shoreline extension containment facilities.

Approximately 140 public shorefront sites and existing DM disposal sites along the coast of LIS in New York and Connecticut have been examined for feasibility as shoreline extension containment areas. These areas mainly consist of parks, beaches, transportation corridors, and military and institutional sites. Of the 140 initial sites, only 24 survived the initial screening analysis in which obvious or gross inadequacies of each site were identified (i.e., proximity to highly sensitive ecological areas, public and private bathing beaches, high wave energy, and land use incompatibility). The remaining 24 sites were examined on the basis of more site-specific criteria and data, and were ranked in relative order of desirability, independently for New York and Connecticut sites. Of these sites, all but nine in New York and three in Connecticut were dropped primarily due to lack of sufficient volume (500,000 cubic yards) for a containment facility. Most of the highest ranking New York sites are located in a tight cluster at the extreme western end of LIS. An additional cluster of three sites is located in Hempstead Harbor in Nassau County. In Connecticut, two of the three remaining sites are located in New Haven Harbor, while the third is located near Bridgeport Harbor. These sites have been recommended for further site-specific environmental, engineering, economic, social and legal analysis.

The top ranking site in New York based on the Interim Report was the New York State Maritime College, located in the Bronx County of New York City. The geographical location of this site is feasible for dredged material containment because: (1) it is not a high density residential area, (2) it does not obstruct main navigation channels, and (3) it is located under the large structure of the Throgs Neck Bridge. The other high-ranking sites in New York were: Little Bay Park and Fort Totten Military Reservation on Willets Point; Morgan Memorial Park, Garvies Point Reserve, and Garvies Point Park on the east side of Hempstead Harbor near Glen Cove Creek; a U.S. Military Reservation on Hart Island; and Ferry Point Park in the Upper East River. The top ranking site in Connecticut, Bayview Park, is located on the west side of New Haven Harbor. Bayview

Park (Long Wharf) is located away from residential areas and is surrounded by major roadways. This site is between three sewage disposal plants and is near, but would not interfere with, the major navigation channel in the harbor and anchorage areas. The other high ranking Connecticut sites were: Seaside Park in Bridgeport, and East Shore Park in New Haven Harbor. Most other sites simply are not compatible due to land use, surface area availability, and proximity to important ecological areas.

Addendum To Interim Report

Scope - A total of 133 public shorefront potential containment sites and existing dredged material disposal sites along the coast of Long Island Sound were examined in the Interim Report. These consisted mainly of parks, beaches, transportation corridors and military and institutional sites. In the addendum this preliminary screening analysis was expanded to include 18 shallow water areas, 31 municipal wastewater treatment facilities, 14 power generating sites, 21 Corps navigation projects with jetties or breakwaters, 11 industrial wastewater discharges, 20 petroleum facilities, and 4 sand and gravel pits.

Contents - The Addendum includes a screening methodology similar to that included in the Interim Report. Also included in the Addendum was a sensitivity analyses for criteria weighting factors. Weighting factors were assigned to the criteria according to the estimated relative importance of each factor. Crieria points represent the physical and geographic characteristics of the alternative sites in relation to optimal conditions. In the application of the siting methodology it became clear that the prioritizing of screening criteria, i.e., the weighting of criteria importance, is a subjective process and should be based on a coordinated effort between the Corps and the various concerned agencies, institutions, environmental groups and general public. To provide a better understanding of the importance of the weighting factors in determining site acceptability, a sensitivity analysis of the criteria weighting factors was presented.

Maps and summaries of the site-specific information for each site or site group which ranked within the top ten for both weighting factor methods were presented.

Findings - On an overall basis, the average percent scores of each site category did not change appreciably, nor did the distribution of site scores based on percent of total. The sensitivity of the secondary screening and ranking process did not appear to be significant based on the two sets of weighting factors tested.

The top ranking potential containment site in Connecticut was a group of sites in New Haven Harbor comprised of the previously analyzed Bayview Park, 2 municipal wastewater treatment plants, and an industrial discharge (Sargent & Co.). The second group, also in New Haven Harbor, consists of 2 local public parks (East Shore and Nathan Hale Parks) the New Haven East

Side Wastewater Treatment Plant and United Illuminating's English Power Station. The third group consists of 2 breakwaters at the entrance to Bridgeport Harbor and an industrial discharger (Remington Electric).

The top ranking NY site consists of the Fort Totten military base at Willets Point and the adjacent Little Bay Park. The U.S. Merchant Marine Academy at Kings Point near the mouth of Little Neck Bay is the second-ranked site and LaGuardia Airport in Flushing Bay was third.

In developing the siting analysis the goal was to identity those sites which came closest to having the characteristics of the ideal containment site. Sites ranking among the highest should have great enough potential for hosting a containment facility to warrant more detailed, site-specific analysis of the engineering, economic, environmental, legal and social acceptability factors, as well as extensive input from appropriate local, state, city and public agencies or groups.

Programmatic Environmental Impact Statement

The Programmatic Environmental Impact Statement (PEIS) for the disposal of dredged material in the Long Island Sound Region assesses several potential open water disposal sites throughout the region and generically discusses other disposal alternatives. Specifically, upland, containment, beach restoration, incineration and resource reclamation are discussed. This document will provide an informational basis upon which supplemental statements or assessments can be developed for individual projects.

The final PEIS was released in June 1982.

The Environmental Impact Statement for the Designation of a Disposal Site for Dredged Material in Western Long Island Sound - WLIS III.

This EIS is tiered to the PEIS discussed above. It specifically addresses the need and the impacts of using the proposed site using information from the PEIS as well as more specific data generated via the Corps' Dredged Material Research Program (DMRP) and the Disposal Area Monitoring System (DAMOS). The final EIS was published in February 1982 and use of the site began in March 1982.

Economic Analysis Of Future Dredged Material Disposal In Long Island Sound

Scope - As Appendix C of the Programmatic EIS for the Disposal of Dredged Materials in the Long Island Sound Region; this section was intended to provide a general framework for future analysis of the economic feasibility of specified disposal sites and methods. It provides projections of future dredging needs in the vicinity of Long Island Sound based upon recent trends in major imports analyzed on a commodity basis.

<u>Contents</u> - Projections of future dredging needs in the vicinity of Long Island Sound depend largely upon future trends in port activity. As is true of all major commercial ports in N.E., the major imports of the larger commercial ports along the Sound are petroleum products. Over the most recent decade for which data was available, trends in total volume shipped through LIS ports show a net decrease of 13,130,834 tons (16.8%), with volume peaking in 1973 and declining steadily through 1977. The major receipt at 6 of the 8 commercial ports in CT is residual fuel oil, the total volume of which has declined by approximately 1 million short tons since 1969. Distillate fuel oil ranks second in quantity received by the majority of ports and appears to be following a declining trend similar to that for residual oil. The third major commodity shipped over LIS, gasoline, has shown an overall net increase over the last decade of approximately 1 million short tons, peaking in the most recent years for which data was available, 1977. The recreational activities -- powerboating, sailing and fishing -- are prevalent along the entire shoreline of the Sound and have been increasing rapidly over recent decades.

The level and types of activity in the many commercial and recreational ports along LIS will influence the future need for dredging. The economic viability of the major commercial ports in CT is dependent upon the shipment of large volumes of petroleum products via barge and tankers drawing up to 38 feet of water. In 1977, petroleum products accounted for approximately 77% of the total volume of shipment through all LIS ports in both CT & NY.

Various projections of future import levels for petroleum products in New England ports including those along LIS are becoming available from a consultant under contract to the New England Division of the Corps of Engineers.

Individual commodity projections by port were developed through the following procedure:

1. Surveyed existing projections of energy consumption in New England and selected the most recent projections of the U.S. Dept. of Energy (DOE), published in August 1979.

2. Identified petroleum product flows throughout New England, i.e., flow of product from port of receipt to its point of consumption during a baseline year of 1977.

3. Identified the geographical market area served by each port in the baseline year, in most cases coinciding with state boundaries.

4. Projected the portion of forecasted demand that will be consumed in each market area.

5. Distributed the forecasted consumption of petroleum products for each market area among individual ports, by taking the product of total consumption of petroleum served by each port and total consumption projected for each port's market area.

The general trend anticipated for ports along Long Island Sound according to the consultant's study is for sharp decline in levels of residual fuel, relative stability in distillate fuel imported, slight decline in gasoline imported, and slight increase in jet fuels and in naphtha (New Haven only).

These data indicate that a major contributing factor in the overall trend toward decreased receipts of petroleum products in LIS ports is the decrease in residual fuel imported for electric power generation. It is anticipated that future levels of coal imports will increase dramatically over the next few decades due to the increasing cost of petroleum. The U.S. Dept. of Energy has projected that coal consumption in N.E. will grow by 34 million short tons between 1977 and 1995. The purpose of projecting future energy needs in the context of this study to assist in the determination of future port needs which in turn dictate future improvement and maintenance dredging needs.

Obviously, establishment of a single future scenario for port activity is speculative at best. A more reasonable approach would establish a range of conditions extending from low growth or no change in port activity to high growth and significant change in channel utilization. The following scenarios reflect this possible range of future port conditions on LIS.

Minimum Growth, Minimum Change Scenario - Minimum growth would asume that none of the major improvement projects currently proposed will prove justified on economic or environmental grounds, and therefore, will not be implemented.

Most Probable Future Scenario - Most probable future activity in LIS ports will reflect some significant changes in channel utilization, though not as extensive as has frequently been anticipated, particularly in the area of coal transport.

Maximum Growth, Maximum Change Scenario - Maximum growth would assume that all major improvements and small projects currently proposed will actually be implemented and that several additional improvements to commercial and recreational ports will be proposed and implemented over the 50 year project life.

Findings - Future dredging requirements at LIS ports depend largely on the level of future port activity. Changing conditions in type and level of activity determines the need for channel improvements as well as for maintenance dredging by the federal government. Projections of future quantities to be dredged from these harbors as federal maintenance

projects are expressed in ranges corresponding to the minimum growth, most probable future and maximum growth scenarios. Table I-2 shows the quantities calculated for the growth conditions.

Projected non-Corps dredging along LIS is more difficult to establish because it is beyond the realm of federal planning, and would become highly speculative, if not impossible, on a port by port basis. It appears to be a reasonable assumption that dredging by permit will continue at approximately the same rate as it has in the past, excluding consideration of the two major U.S. Navy dredging projects at New London Harbor in recent years.

Interim Plan For The Disposal Of Dredged Material From Long Island Sound

Scope - The purpose of the Interim Plan was to establish an agreement between the states of Connecticut and New York on the conditions under which the open water disposal of dredged material will take place in Long Island Sound. The New England River Basins Commission served as the vehicle to establish an understanding among all the agencies with responsibility for dredged material disposal decisions on the elements of this basic disposal program.

Contents - The Interim Plan constitutes an agreement among the legally responsible federal, state, and interstate agencies on a set guidelines for the open water disposal of dredged material from Long Island Sound. The plan is consistent with the provisions of the Clean Water Act of 1977 and is designed to complement EPA published guidelines on the discharge of dredged material by establishing additional regional guidelines for the implementation of federal regulations and state water quality certification and a process for inter-agency coordination on enforcement procedures.

The basic concerns underlying this inter-agency effort to establish regional groundrules for dredged material disposal activity, are the need to maintain the viability of the commercial and recreational ports and harbors of Long Island Sound while minimizing environmental impacts from dredging activity.

Findings - In order to accomplish the objectives, the plan recommends a continuation of carefully controlled and monitored open water disposal at three designated areas (located near New Haven, Cornfield Shoals, and New London) in Long Island Sound, with case-by-case evaluation of disposal actions and cooperative procedures for the processing of disposal permits. The need for a site in western LIS was also recognized. The procedures agreed to in the Plan should expedite necessary dredging through a project review process that is fully consistent with the provisions of federal and state laws and policies governing open water disposal. It is intended that the Interim Plan serve as a guide for the regulation of open water disposal in Long Island Sound.

TABLE I-2
PROJECTED FEDERAL MAINTENANCE DREDGING
1985 - 2035 AVERAGE ANNUAL VOLUME (C.Y.)

Coastal Area	Minimum Growth	Most Probable Future	Maximum Growth
Western Connecticut	89,700	113,900	139,100
Central Connecticut	210,800	257,700	292,600
Eastern Connecticut	15,600	31,400	37,200
Westchester County	5,000	7,000	10,600
Nassau County	2,400	6,540	4,400
Suffolk County	3,740	6,540	8,180
New York City	38,600	49,300	58,700
TOTAL	361,340	469,440	555,980

New Haven Harbor Coastal Development For Navigation

This Congressionally authorized study was carried out to determine the engineering feasibility, economic justification, & environmental acceptability of modification of the existing navigation project in New Haven Harbor. Historically, the economy of the New Haven area had depended on shipping activities, and the port has been the dominant influence in stimulating the industrial growth and economic progress of south central Connecticut. The harbor's major navigational problem is the lack of adequate channel dimensions and maneuvering area of sufficient depth to handle larger vessels now coming into general use in the petroleum trade.

In order to formulate plans for solving harbor problems, all possible management measures were identified. Equal consideration was given to both structural and non-structural measures during the study process. Measures that were identified as possible ways to improve navigation in the area are:

- Utilize Favorable Tides
- Navigation Aids (buoys)
- Multiport Operations
- Lightering
- Change in Vessel Design
- Utilize Other Ports
- Pipelines
- Offshore Unloading Facility
- Improving Navigation Facilities

These measures, each of which addresses one or more resource needs, were then developed into alternative plans. Improving navigation facilities has been selected as the recommended plan.

This plan consists of the following improvements:

- Deepen the main ship channel from 35 feet to 40 feet from deep water in Long Island Sound along the line of the existing 35-foot deep channel a distance of about 36,000 feet upstream to the end of the existing Federal project.

- Widen the main ship channel from 400 feet to 500 feet over a distance of about 20,900 feet or 4.0 miles, thus creating an overall ship channel 500 feet wide from deep water in LIS to the upstream end of the existing project, a distance of about 36,600 feet or about 6 miles.

- Realign the ship channel beginning at Station 110+00 and continuing north to the upstream limit of the existing project at Station 13+00, an overall distance of about 9,700 feet.

• Widen the channel bend at Southwest Ledge from a minimum of 560 feet to a minimum of 780 feet.

• Provide a common turning basin, approximately 1,200 feet wide (irregular octagon), 40 feet deep centered at about Station 45+00.

With this plan, including related interior access channels and terminal berth areas, it would be necesary to remove and dispose of an estimated 4.4 million cubic yards of unconsolidated materials and 27,200 cubic yards of rock. This 40-foot project proposal when compared with the 41-foot project plan in the Feasibility Report represents a 300,000 cy reduction in dredged materials. Bucket and dipper type dredges are proposed for dredging and all material would be transferred into dump scows and transported to two openwater sites. Disposal operations would take place in the harbor about one mile east of the ship channel at Morris Cove by filling a manmade hole with about 900,000 cy of suitable materials including 27,200 cy of rock. The remaining volume, some 3.5 mcy would be deposited at the Central Long Island Sound Disposal Site located about six nautical miles south of the entrance to New Haven Harbor.

Disposal Area Monitoring And Observation Studies (DAMOS)

DAMOS is an interdisciplinary effort rather than a collection of separate tasks performed within distinctly separated disciplines. It is a regional ocean disposal monitoring program with a substantial degree of continuity while being flexible, developmental and innovative. The objectives and milestones for each aspect of the program are developed by conference of all principal investigators and Corps managers in an effort to gain some understanding of a heretofore little explored area. The DAMOS program represents the Corps of Engineers (NED) response to its mission of regulating ocean disposal in terms of scientific inquiry into environmental effects of that activity. As such the program fully supports the regulatory program's everchanging needs of bioassay and risk comparison. Problems addressed by DAMOS include siting considerations, the relation of site recovery processes to biological succession, how much disturbance to permit at any one time, quantification of effects, stratigraphic encapsulation, and others. It involves seasonal cruises, the necessity to separate normal variation from abnormal events, and the identification of abnormal events. These phenomena must be learned for each major site. There are more than 10 such sites in New England, in two tidal systems, and in depths of ocean ranging from 60 to in excess of 200 feet and reaching distances of up to more than 10 miles offshore.

Original, advanced, computerized navigation and microbathymetric analysis systems essential to monitoring activities have been developed under DAMOS, as have the BOLT system for sediment-water interface boundary layer studies, a customized suspended sediment sampler, a "black box" for disposal scow position monitoring, mussel cages, bottom release arrays and taut-tether buoys. The extensive DAMOS data base relies on quality control and assurance programs involving intercalibration of other

laboratories with NED Materials and Water Quality Laboratories. The senior diving biologists used in the DAMOS program are recognized experts in New England fisheries biology. They and accompanying divers in the program conduct observations of dredged material spoil piles, photographing and studying the recolonization of benthic organisms, habitat development and sediment characteristics and distribution. These cumulative data constitute the data base on which seasonal changes are being assessed in comparison with nearby virgin areas ultimately leading to conclusions with respect to the assessment of long term effects as required of the Corps by EPA and State regulations. DAMOS physicists and geologists will intergrate three dimensional data on the dynamics of sedimentation in the boundary layer between sediment and water with suspended sediment data. The data thus obtained are to be integrated with surface wave data and transmitted ultimately to the Water Control Branch, NED, by satellite buoy, which is in the early development stage.

DAMOS will continue to participate in the International mussel watch program, sampling mussels from cages placed on dredged spoil piles, testing them for metals and organohalogens and examining their cell tissues for possible abnormal growth. Other in situ field bioassay techniques are currently under consideration.

General

Scientific papers and reports on the ecology of LIS are abundant, and harbor-specific environmental assessments and feasibility reports prepared by the New England Division are also available. In addition, the Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi has published numerous state-of-the-art documents under the recently concluded Dredged Material Research Program (DMRP).

The DMRP Synthesis Reports most relevant to this study are:

Confined disposal area effluent and leachate control (laboratory and field investigations). Technical Report DS-78-7.

Disposal alternatives for contaminated dredged material as a management tool to minimize adverse environmental effects. Technical Report DS-78-8.

Assessment of low-ground-pressure equipment for use in containment area operation and maintenance. Technical Report DS-78-9.

Guidelines for designing, operating, and managing dredged material containment areas. Technical Report DS-78-10.

Guidelines for dewatering/densifying confined dredged materials. Technical Report DS-78-11.

Treatment of contaminated dredged material. Technical Report DS-78-14.

Upland and wetland habitat development with dredged material ecological considerations. Technical Report DS-78-15.

Wetland habitat development with dredged material: engineering and plant propagation. Technical Report DS-78-16.

Development and management of avian habitat on dredged material islands. Technical Report DS-78-18.

An introduction to habitat development on dredged material. Technical Report DS-78-19.

Productive land use of dredged material containment areas: planning and implementation considerations. Technical Report DS-78-20.

EXISTING PROJECTS

There are currently 27 Federal navigation projects, 19 shore protection projects, 26 flood control projects and hurricane protection projects authorized in Connecticut. These projects are identified in Table I-3.

In the New York portion of LIS, there are 19 Federally authorized projects, which are identified in Table I-4. Five projects west of the Throgs Neck Bridge in the Upper East River are included since this area has historically seen significant dredging activity and may have bearing on future dredged material disposal operations in western LIS.

Table I-3

FEDERAL PROJECTS IN CONNECTICUT

Western Coastal Area

1. Greenwich Harbor
2. Mianus River
3. Stamford Harbor
4. Westcott Cove
5. Fivemile River Harbor
6. Wilson Point Harbor
7. Norwalk Harbor
8. Wesport Harbor and Saugatuck River
9. Southport Harbor
10. Bridgeport Harbor
11. Housatonic River

Central Coastal Area

12. Milford Harbor
13. Breakwaters at New Haven
14. New Haven Harbor
15. Branford Harbor
16. Stony Creek
17. Guilford Harbor
18. Clinton Harbor
19. Duck Island Harbor
20. Patchogue River
21. Connecticut River below Hartford

Eastern Coastal Area

22. Niantic Bay and Harbor
23. New London Harbor
24. Thames River
25. Mystic River
26. Stonington Harbor
27. Pawcatuck River

TABLE I-4

FEDERAL PROJECTS IN NEW YORK

Westchester County

1. Portchester Harbor
2. Milton Harbor
3. Mamaroneck Harbor
4. Echo Harbor
5. New Rochelle Harbor

Nassau County

6. Hempstead Harbor
7. Glen Cove Creek

Suffolk County

8. Huntington Harbor
9. Northport Harbor
10. Port Jefferson Harbor
11. Mattituck Harbor
12. Greenport Harbor

New York City

13.	Eastchester Creek	
14.	Little Neck Bay	
15.	Westchester Creek	(not on LIS)
16.	Bronx River	(not on LIS)
17.	Flushing Bay and Creek	(not on LIS)
18.	Harlem River	(not on LIS)
19.	East River	(not on LIS)

CHAPTER II

DREDGING & CONTAINMENT FACILITY DESIGN CONSIDERATIONS

Chapter II

DREDGING AND CONTAINMENT FACILITY DESIGN CONSIDERATIONS

FIGURES

DREDGING METHODS

There are two methods of conducting dredging operations: mechanical dredging and hydraulic dredging. There are several variations of each.

The most common dredging method utilized in Long Island Sound is the mechanical bucket and scow. The concept of operation is quite simple. The material is "scooped" from the bottom by a jaw shaped apparatus called a clamshell which is mounted on a barge and then deposited into a scow for transport to the disposal site. The material is discharged via bottom-opening doors which allow the entire load to be dropped essentially as one mass. This type of operation results in minimal dispersion of the sediments into the surrounding environment at both the dredging site and its disposal area because the soil remains intact and is not agitated as with other dredging methods. Under proper conditions, the load may be discharged very accurately at the disposal site.

There are several different types of bucket and scows that are used in Long Island Sound harbors. In some of the small maintenance jobs, the clamshell is mounted on the scow itself. A tug boat manuevers the scow within the dredging project limits and hauls the scow to a disposal site. Another type is a self contained unit which has a tug, scow, and clamshell all combined on one barge. Scows come in all sizes from a small 200 cubic yard capacity which draws as little as 5 feet when filled, to the large ocean going scows which have maximum capacities in the 3000 cubic yard range, but draw 16 to 18 feet of water - much to large for most Long Island Sound small boat harbors. Much larger scows are used in other parts of the world where dredging volumes are much greater. (The New Orleans District which maintains the lower Mississippi River system annually dredges about 75 MCY, larger than the combined permit and Federal dredging for Long Island Sound for the next 50 year period.)

A hydraulic dredge operates similar to a vacuum cleaner. A suction tube, generally equipped with a rotating cutter head, dislodges the bottom sediment. The suction provided by the onboard pumps move the bottom sediment, along with about 4 to 5 times as much water through a series of floating pipeline and deposits the slurry onto a beach, into a containment facility, or to an upland disposal site. The friction losses in the pipes and size of the pumps limit the maximum effective length that a hydraulic dredge can operate. In the case of an upland site, the elevation of the facility also becomes a limiting factor. Theoretically, a small hydraulic dredge with a 10" suction tube has a maximum length of pipe of less than 1/2 mile whereas some of the new 30" hydraulic dredges with proportionally larger pumps can move the dredge material over 4 miles unaided by booster pumps. Booster pumps, similar to a second hydraulic dredge, can be added to increase the distance covered. Considerable support equipment is required when hydraulic dredging is employed. Pipes, pipe barges, tenders (small tugs), work boats and a winch are all required for even the smallest of hydraulic dredging operations. However, when compared to the bucket and scow operations, the volumes of material moved per hour is much greater.

A variation of a hydraulic dredge is a hopper dredge. Generally the dredge pipe is dragged along the bottom by the motion of the boat. The material is placed into onboard hoppers by means of large centrifugal pumps. Some hopper dredges are as small as 500 yards while the newest large hopper dredge holds over 8000 yards, but draws over 30 feet of water. When the onboard hoppers are filled to capacity the dredge stops working. It then travels to either an open water site where the bottom gates are opened and the material is discharged as a mass similar to a scow, or the dredge goes to a containment facility or upland site, places or ties into a piping network, puts its pumps in reverse and discharges the material from its hoppers to the disposal site. Dredges of this type can work in open waters in virtually all conditions. They have been used in several of the large Connecticut harbors.

Another type of a hydraulic dredge is a sidecast dredge. The physical appearance is similar to a hopper dredge but has a long side casting arm attached to it. The dredged material is removed similarly to the hopper dredge but instead of being stored on board, it is discharged through its side cast arm out and away from the channel by distances approaching 300 feet. Dredges of this type have infrequently been used in Connecticut. One was used at Clinton Harbor within the past decade. The dredged material being moved would have to be predominantly sands to be effective.

DREDGED MATERIAL CHARACTERISTICS

The characteristics of dredged material (DM) determine sediment behavior during containment processing, determine possible DM products, and indicate the probable environmental impacts of containment.

The physical characteristics of dredged material are of interest mainly in the design and operation of the containment facilities. These effects are well documented in the pertinent literature of the DMRP Program and are briefly described below. The sediment particle size distribution establishes settling characteristics and, hence, required containment area design. The specific gravity of solids affects settling velocity of particles and, hence, settling basin design area and dep h. This information along with the inflow rate of the dredged materia from the hydraulic dredge are major data requirements for proper outle facility design and containment area sizing. If there is a planned use of the facility after completion of the filling activities, an increase in sediment consolidation will be required. This can be accomplished by means of dewatering and/or densifying the dredged material. A pa sive type reuse opportunity such as a wildlife habitat will only req e dewatering and minimal densification. (See section on Dredged terial Containment Facility Operations, page 10.)

The chemical characteristics of dredge material are of prime concern for environmental impact potential through plant uptake of toxic substances, contamination of groundwater and surface receiving waters from

leachate and dewatering effluents, and direct contact with biological organisms due to dredged material containment operations. Typical chemical/biological testing of dredged material characteristics include (1) bulk sediment analyses (2) elutriate tests, and (3) bioassay tests for selected marine species of local importance.

The bulk sediment analysis (1) is used as an indicator of what chemicals are present in the sediment and therefore what chemicals might be looked for in other more sensitive tests. The test involves the digesting of sediments with an acid and the resulting solution then being tested for such constituents as heavy metals (mercury, cadimum, arsenic, and generally 6 others), organic compounds such as DDT, PCB, and other such chemicals. The test has only limited value because it does not indicate the biological availability of any of the chemicals being measured. It does however provide a basis along with other physical data for making comparisons between sediments and assessing the relative levels of contamination.

The Elutriate Test (2) is used to indicate the amount of contaminants that might be released into the surrounding water during dredging and disposal operations. The test consists of combining 1 part sediments with 4 parts water from the dredging site. This is mixed for 30 minutes and then allowed to settle for 1 hour. After settling the mixture is centrifuged and filtered. The liquid is then tested for many of the same chemicals measured in the bulk sediment test.

The test used for evaluating potential biological impacts from open water and ocean disposal is the Bioassay Test (3). This test is intended to evaluate whether disposal would cause any "unacceptable environmental impacts" to organisms either from sediment toxicity or from the bio-accumulation of chemicals. In this test marine organisms are placed in tanks and observed for specific periods of time. The test results are statistically analyzed to determine if the results were a random occurrence or were caused by the test sediments.

In the sediment toxicity test, three phases can be analyzed - the liquid, suspended particulate, and solid phases. These phases relate to what may occur when dredged sediments are disposed in water; that is, sediments can contain a substantial quantity of water which can be released and mixed with the disposal site water. This correlates to the liquid phase of the bioassay test. Sediment can also contain substantial amounts of fine particles, which can also be released into the disposal site water. The suspended particulate phase portion of the test simulates this condition. Of course a substantial portion of the dredged material would reach the bottom of the disposal site. This is correlated to the solid-phase portion of the test. Finally, the organisms that survive the solid phase are analyzed to determine if they have accumulated mercury, cadmium, petroleum hydrocarbons, polychlorinated biphenyls (PCB's) and compounds in the DDT family.

THE CONNECTICUT - NEW YORK INTERIM PLAN CLASSIFICATION SYSTEM

The Interim Plan is the culmination of considerable negotiation among New York, Connecticut, Federal and interstate agencies responsible for dredging and disposal in Long Island Sound. What emerged is a consensus on policies and recommendations for review procedures and management techniques for open water disposal of dredged material at three sites (on an interim basis), thorough evaluation of alternative courses of action (such as upland disposal, island building, and marsh creations) is completed, and a long-term dredging management plan formulated.

The following applicable paragraphs and summaries have been extracted from the interim plan.

Open water disposal of dredged material in Long Island will be limited to three interim disposal sites. The use of these sites will be reviewed. Additional sites may be considered for designation based on the result of the Corps of Engineers "Programmatic Environmental Impact Statement for the disposal of Dredged Material from Long Island Sound" (PEIS).

The following three areas will be kept open for interim dredged material disposal activity:

a. A two square mile area in the middle of the Sound south of New Haven, Connecticut, in the vicinity of the historical "New Haven" dumping grounds. This site is to be referred to as the "Central Long Island Sound Regional Dredged Material Disposal Area".

b. A one square mile area in the middle of the Sound south of the mouth of the Connecticut River in the vicinity of the historical "Cornfield Shoals" dumping grounds. This site is to be referred to as the "Connecticut River Regional Dredged Material Disposal Area".

c. The historical New London dumping grounds is designated on an interim basis pending results and recommendations of on-going disposal monitoring and research. This site is a one mile square area south of the mouth of the Thames River.

(A fourth site has been recently approved for use based upon the PEIS. The site, called Western Long Island Sound III (WLIS III) disposal site, is located within the triangle bordered by the Stamford disposal site on the west, the south Norwalk disposal site on the northeast and the Eaton's Neck disposal site on the east.)

In the absence of more definitive knowledge on the pollution effects of dredged material or on the specific pollutants found in dredged sediments at the disposal sites, the following physical and chemical parameters will be used to determine whether biological testing of sediments will be called for in the review of a disposal action or what conditions will be placed on the disposal of the dredged material.

Dredged material sediment is classified as follows:

	Class I	Class II	Class III
Percent oil and grease (hexane extract)	<0.2	0.2-.75	>.75
Percent volatile solids (NED method)	<5	5-10	>10
Percent water	<40	40-60	>60
Percent silt-clay	<60	60-90	>90

Relative to the subjective probability for adverse environmental impact these parameters rank in descending order of significance: oil and grease > volatile solids > percent water > percent silt-clay. For example, sediment analyses may yield Class III percent silt-clay, Class II percent water, and Class I percent volatile solids and oil and grease, or any other combination. This sediment would be judged as Class II material; similarly, Class I silt-clay, Class I water, Class II volatile solids, and Class III oil and grease would probably be judged Class III material.

Class I sediments are often relatively coarse-grained with high solids content; volatile solids, oil and grease, heavy metals, and potential pollutant concentrations are low. Class I sediment may be judged "clean, relatively clean," and/or non-degrading based on a case-by-case subjective evaluation of the dredged site and/or metals concentration. Class I materials include non-recent and recent sediments which are suitable for capping materials at open water dump sites, for habitat creation projects, or rehandling for productive uses including beach nourishment and land fill cover based on the evaluation.

Class II sediments are often relatively fine-grained with moderate solids content. Class II materials may contain a moderate amount of potential pollutants, volatile solids, oil and grease, and metals, at levels often sufficient to be a cause for concern. A subjective evaluation of the dredged site and metals is needed to designate this material as either "non-degrading" or "potentially degrading". Potentially degrading Class II material will be treated as Class II material. On the other hand, this evaluation may show that some Class II material is suitable for habitat creation projects, capping Class III materials, and landfill cover.

Class III sediments are usually fine-grained with low solids content. These materials often contain high levels of potential pollutants, volatile solids, oil and grease, and metals. Class III sediments may be judged "potentially degrading" or "potentially hazardous" based on the relative concentrations of pollutant constituents. The

probability for Class II sediments being "toxic" to marine bottom fauna may be high. Subjective evaluation of metals and other pollutants, and objective review of bioassay and/or bio-accumulation test results, may be required to determine the suitability of Class III material for open water disposal at Long Island Sound regional disposal areas.

As a general policy, Class III material will not be dumped at regional disposal sites unless it is capped with suitable Class I or Class II material. Therefore, the conditions under which Class III material may be dumped may include both temporal and seasonal restrictions relating to the availability of suitable material for capping or alternative management techniques directed towards the goal of maximum environmental protection. In addition, there mav be certain circumstances under which open water disposal may be prohibited.

Class I material is considered clean material acceptable for beach nourishment or open water disposal at regional disposal sites or at a site of similar lithologic background. Class II material may be discharged at any one of the four identified disposal sites. Class III material is considered to be contaminated and may only be considered for open water disposal is there is a compelling necessity to accomplish the dredging and special mitigating measures such as capping and seasonal constraints are employed to prevent adverse environmental impacts.

For the purposes of this report "objectionable material" will include at least Class III material and in some instances Class II material would be included.

ADDITIONAL INFORMATION ON CONTAINMENT FACILITIES

As mentioned throughout this report, considerable information was obtained from the guidance provided by the Dredged Material Research Program (DMRP). Congress authorized the Corps of Engineers to conduct the DMRP Program, a nationwide research program on the effects of dredged material disposal. Over 250 individual studies were conducted between 1973 and 1978 at a cost of $32.0 million. In contrast to previous largely site-specific project investigations these studies were generic in nature with the intent of developing methods of predicting effects before a project is carried out.

Some of the more significant findings of the DMRP as relative to containment facilities are summarized below.

For coastal and inland areas, the DMRP achieved definitive results that soundly substantiate that most widely held fears over the short-term release of contaminants to disposal site waters are unfounded. As long as the geochemical environment is not basically changed, most contaminants are not released from the sediment particles to the water. However, in contrast upland disposal often does result in a change in the geochemical environment that can lead to contaminant release. Some nutrients such as

ammonium and manganese and iron are released in open water sites, but in most cases enough mixing is present to rapidly dilute these harmless concentrations. Situations where toxic effects could occur would most likely be where pipeline dredges are discharging large volumes of material into very shallow estuarine waters.

The difficult problem on the effects of turibidity or suspended sediment particles on both water quality and aquatic organisms was addressed with significant results. It was found that, except in unusually environmentally sensitive areas such as coral reefs, turbidity is, primarily, a matter of aesthetic impact rather than biological impact. It is, of course, often advisable to schedule dredging and disposal operations to avoid disrupting spawning activities and fish migrations. However, studies showed that most adult organisms can tolerate turbidity levels and durations far in excess of what dredging and disposal operations produce.

It was shown that certain aquatic organisms will uptake chemical contaminants from dredged material. However, the patterns of uptake was found to be unpredictably erratic and there was no clear trends.

Confined or diked containment of dredged material as a conventional alternative was also extensively investigated. Confining contaminated material on land or in shallow water next to land can be an environmentally sound and preferred alternative, but not inherently better than open-water disposal for several reasons. There are technical reasons why confined disposal could be less effective in protecting water quality or organisms. These include the change in the geochemical environment that could lead to an enhanced release of contaminants and the difficulty in retaining the finer grained particles in environmental settings where they are likely to have greater impact when released (e.g., wetlands or small streams. This is mainly applicable in fresh water environments). Also, it should not be overlooked that confined facilities are expensive, of finite life, and result in a permanent change in the physical landscape, often in conflict with land-use and management plans. (This alternative would have to be compared to open water disposal which is also expensive and possesses many of the same concerns as containment siting problems).

Irrespective of the alternative decision, if a confined disposal area is to be constructed, it must be designed, built, and operated in such a way as to achieve maximum effective capacity and satisfactory effluent quality. Unfortunately, historically, neither of these basic objectives has been met by some of the faciliites that have been built. These objectives are by no means mutually incompatible and the reasons they have not been met involve lack of technical knowledge as well as policy and institutional factors such as cost, funding sources, and diffused construction and management responsibilities.

The DMRP developed and issued in report and manual form a variety of guidance and information that should largely alleviate the technical knowledge limitation. No longer is it necessary to rely primarily on "rule of thumb" and personal experience. Specific guidelines were prepared for designing containment areas with appropriate storage capacities, surface areas, and shapes; designing and building dikes; designing and placing inflow pipes and wires; selecting equipment for operating in disposal areas; landscaping containment areas; and controlling problems such as mosquito breeding and noxious odors.

If a confined site is to be effective from an environmental protection standpoint, it must be efficient in retaining a high percentage of the finer soil particles, for it is the clays and silts that carry the contaminants. These are admittedly the materials most difficult to retain in an area, but if they can be, the effluents should be essentially nontoxic except for occasional situations where nutrient levels and oxygen depletion may be excessive.

The guidance mentioned above contains specific information on how disposal site retention times can be maximized; however, there are cases where sites are simply incapable of providing adequate retention. Addressing these situations, studies found that coagulants and flocculents can be quite effective for effluent treatment, and treatment system design and operation guidelines were developed based on actual field tests. Studies also considered the principles involved in the land treatment of wastewater and concluded from a limited field test that the regulated discharge of disposal area effluents through a natural marsh can be effective in removing nutrients.

Dredged material, particularly dewatered dredged material, has value for landfilling or in construction. Every cubic yard that can be removed from a containment area and used, donated, or sold offsite for any purpose is a cubic yard of new storage capacity gained. In conjunction with the Corps Districts, concepts were developed for disposal area reuse for both separating and handling materials in a site, and actual field situations have demonstrated that uses within the site for purposes such as haul road construction and dike raising are too often overlooked as completely viable concepts. (However, not all dredged material is suitable for such reuse opportunities).

Dredged material is also a substance that can be used to create or improve wildlife habitats - examples of this already exist in nearly all parts of the country. However, it is known that the past occurrences were primarily accidental rather than planned. Realizing that even the most productive habitats sometimes can be out of place within an ecosystem, the DMRP concentrated on understanding the natural processess and developing guidelines on exactly what should be done, where and when, and what are the relevant considerations in all phases from site selection to follow-up management.

Considerable attention was given to the uptake of chemical contaminants by marsh plants as an obvious concern in decisions on developing marsh habitat using dredged material. Uptake was found to occur in different ways and at different rates in most plant species, but the amounts of contaminants involved were not so large as to cause major concern. The question of how much uptake is too much was not resolved and is not likely to be anytime soon; however, evaluations of uptake should be made with an awareness of the natural functioning of a wetland system as a contaminant processor. The end product sought by the research was a test that can be used to predict the pattern of uptake from a particular type of material. To this end, it was largely, but not entirely, successful since certain contaminants have proven diffficult to predict as far as behavior is concerned.

Marsh creation using dredged material is now a proven, viable alternative that can be designed and implemented as reliably as any other alternative. Also, certain misconceptions about this alternative were firmly dispelled. In particular, it can be easily demonstrated that marsh development does not necessarily eventually preclude the disposal of material from subsequent maintenance dredging projects. There are examples where phased marsh development, with or without disposal alternatives, has been planned in such a way as to accommodate maintenance dredging for periods of 50 years or more.

Small islands created by dredged material disposal in inland waterways and coastal bays and estuaries are a special type of upland habitat development. Several regional surveys showed that many of the more than 2000 of these islands have become extremely valuable wildlife habitat. In fact, maintenance of the United States population of several colonial nesting birds such as sea gulls, terns, and herons is dependent upon islands of this type.

Thus, island development obviously can be an environmentally beneficial disposal alternative and one that has large public acceptance. The DMRP provided guidance on how islands can be designed and managed to be of greatest value to certain target species and how the natural evolution of the islands can be controlled for maximum wildlife benefit. However, there are problems, both real and imagined. In the former category are the conflicting concerns and needs of the wildlife interests and the fisheries interests who often have opposing views on the need for islands versus open water. This type of problem can only be resolved on a case-by-case basis. In the latter category is the widespread belief that once an island is created and inhabited by desirable wildlife, it can never again be used as a disposal site. This is not true! In fact, studies showed that unless natural vegetational successional patterns are occasionally interrupted, the islands will lose their wildlife value. The most practical way of providing the needed interruption is by depositing a new layer of material. Specific guidance includes managment techniques on how continued disposal can be phased with optimum wildlife use. Once again, the key is a sound management plan.

Considering productive uses of dredged material, the obvious value of the land created when a disposal site reaches capacity was not overlooked. Most disposal sites filled with fine-grained materials from maintenance dredging are not suitable for industrial or commercial development from a foundation engineering point of view, but they can be ideally suited for recreational development. One study pointed out the issues related to such use of disposal sites, including funding availability, maintenance responsibility, and guarantees of public land use. Another analyzed case histories in an attempt to find out why certain productive land uses have succeeded and others have failed. These include but are not limited to recreation uses. Other studies evaluated laws and regulations at all levels impacting on land uses and determined the land values and associated benefits created by disposal sites. The end products are guidelines on how the Corps or other groups can achieve or promote the productive subsequent uses of disposal sites both for the inherent benefit of doing so and the probability of being able to acquire new sites more easily.

OPERATION AND DESIGN ASPECTS OF A DREDGED MATERIAL CONTAINMENT FACILITY

The principle objectives in designing a DM containment area are: to provide adequate storage capacity to meet the long term dredging requirements, and to maximize solids retention during the dredging operation in order to meet effluent suspended solids requirements. These considerations are basically interrelated and depend upon effective design, operation, and management of the containment area.

Simply stated, a dredged material containment facility retains dredged material solids while allowing the carrier water to be released from this containment area. The percentage of materials retained is dependent upon the various design considerations and the actual field operations at the time of a disposal activity. A well designed, constructed and operated facility will retain a very high percentage of solids, especially in salt water. The major portions of a containment facility are shown schematically in Figure II-1.

Retaining dikes are used to form the containment facility. Constructed of earth and rock, the retention dike cross section will have a similar appearance to breakwaters and jettys in harsh coastal waters and resemble earth dikes in calmer locations. The retention dike will be specifically designed to retain the solids portion of the dredged material and under controlled conditions release the liquids by weir design and or seepage through the embankment. The location of a retaining dike will be established by factors including foundation conditions and available borrow material. The height, cross section and alignment of the retaining dikes are generally dictated by containment capacity requirements, availability of construction materials, and prevailing foundation conditions.

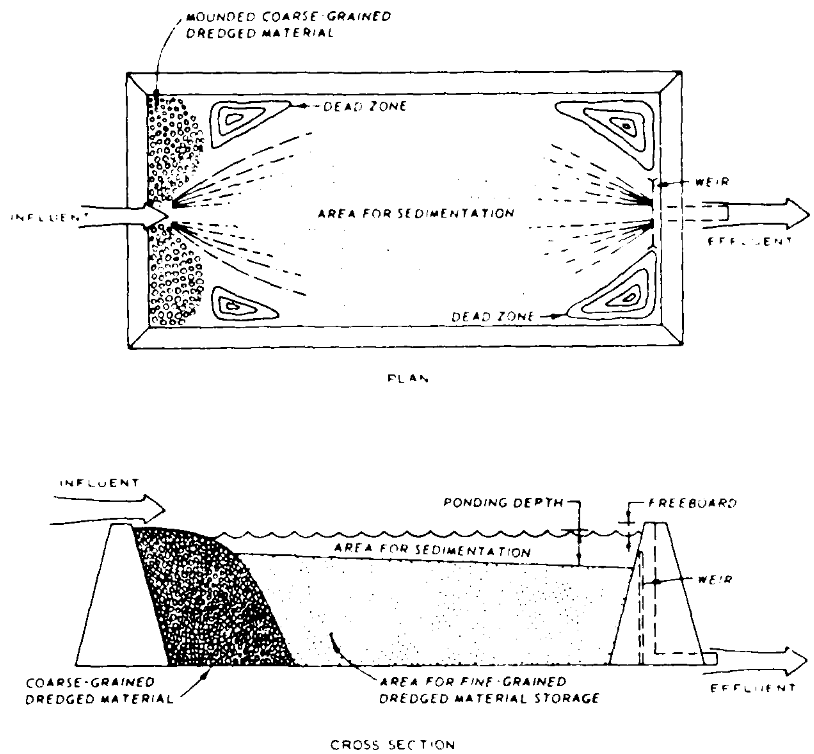


FIGURE II-1 CONCEPTUAL DIAGRAM OF A DREDGED MATERIAL CONTAINMENT AREA

There are three major items in containment facility plans which require significant design applications or considerations: The containment dike design, the containment area design for retention of suspended solids, and the weir design. Some of the factors which should be considered in the design and construction of retaining dikes are topography of site, foundation conditions, availability of construction materials (soil, rock), construction method, stability of dike embankment and foundation soils, settlement, seepage control, and design wave heights.

It is far beyond the intent of this progress report to attempt to describe the significance and design considerations of the above items. If the reader is interested in further information on dredged material containment facilities, a list of containment facility literature is shown at the end of Chapter I.

The management activities performed before, during, and following the dredging operation are required to maximize retention of suspended solids and storage capacity of the containment area. The activities which would be applicable to us would include site preparation, removal and use of previously deposited dredged material for construction purposes, surface water management, suspended solids monitoring, inlet and weir management, dredged material dewatering, and disposal area reuse management.

The management of surface water during the disposal operation is performed by controlling the elevation of the outlet weir(s) throughout the disposal operation to regulate the depth of water ponded within the containment area. Proper management of the surface water is essential to ensure proper effluent from the containment facility. The concept of operation is simple. At the start of a disposal operation, the outlet weir is set at a predetermined elevation by means of a series of weir boards, or stoplogs, placed in the weir structure. This elevation will ensure that the ponded water will be deep enough for settling of the dredged material as the area is being filled. This is referred to as the ponding depth. The greater the pond depth with the same inflow rate of dredged material the longer the dredge material will have to settle out. (this is called the detention time). Conversely, by reducing the ponding depth, the less time available for settling to occur, and therefore, the greater the percentage of fine grained materials which may be present in the effluent from the containment facility.

As the disposal operation begins, a slurry (4-5 parts water to 1 part dredged material) is pumped into the containment facility. No effluent is released until the water level reaches the weir crest elevation. Effluent is then released from the containment facility at about the same rate as the slurry pumped into the area. As the slurry is pumped in solids are settled out, therefore reducing the available ponding depth as the thickness of the dredged material increases. Because of the time it takes for a particle of dredged material to travel from the inflow pipe to the effluent area, a very high degree of sedimentation occurs. The degree of

treatment necessary is a function of the settling characteristics of this dredged material. After completion of the disposal operation and the activities requiring the ponded water, the water is removed as quickly as effluent standards will allow by means of removing the stoplogs on the weir systematically.

As part of a containment facility dredging and disposal operation, a well planned monitoring program that lasts the entire dredging operation is essential to ensure that effluent suspended solids remain within acceptable limits. Suspended solids concentration are determined by laboratory analysis. It is desirable to complete a series of tests during the initial stages of the dredging operations. Indirect indicators of suspended solids concentrations can be as simple as comparing a sample of the effluent to a known or previously determined sample. The DMRP literature suggests that inflow samples be taken every 12 hours of continous dredging operations and that effluent samples be drawn at 6 hour intervals.

Dewatering/densifying dredged material begins as soon as all the carrier water flows through the overflow weir. Although a significant amount of water is removed from a containment facility through the overflow weirs, the confined fine-grained dredged material usually settles out/consoldiates to only a semifluid consistency that still contains large amounts of water. The volume occupied by this liquid portion of the dredged material greatly reduces available future disposal volume and the high water content also makes the facility unsuitable for most productive uses.

There are three reasons for dewatering fine-grained dredged material in a containment facility; (1) promotion of shrinkage and consolidation leading to more volume in the existing disposal site for additional dredged material; (2) reclamation of the dredged material into more stable soil form for possible removal and use by others which in turn creates additional storage volume; and (3) creation of land with predictable geotechnical properties. The net effect of implementing any program of dewatering will be: disappearance of ponded surface water; the majority of precipitation will run off the site within a few hours after the storm; the dredged material will be gradually dried to more stable soil form; vertical settlement of the surface of the disposal area; vegetative cover may become established on the site.

It should be noted that dewatering/densifying a marsh creation project is not necessary. In this instance the dredged material would be allowed to settle out within the containment dikes. This would generally be completed within 24 hours of the dredging activity. The stop logs would be removed from the weir structure and the tide would be allowed to act naturally within the containment area. While there may be some minor resuspension of the sediment, the material would be generally clean and natural to the area's environment.

A containment facility would in all likelihood be broken down into several individual units called cells. The dredged material would initially be pumped into the first cell having available storage volume and allowed to settle out with its carrier water passing through the overflow weir. In some previously built and operating containment facilities, the water passes through the overflow weir to adjacent cells affording additional settling time with an appropriate higher degree of treatment obtained in each. As a cell is filled to capacity, it is essential that an appropriate use be made of it. Numerous examples of the potential use of a filled containment cell (or later in time the entire facility) are scattered thoughout the world. There are seven categories of land use which may be made of a containment cell.

Recreational
Industrial/Commercial
Agricultural
Institutional
Material Transfer
Waterway Related
Multiple Purposes

Numerous examples of each use has been established in the literature. Well over 200 facilities have been built in the United States alone. Many of these have recreational aspects which are a major component of the final plan.

The development of a containment facility for subsequent land use requires consideration of numerous factors; engineering; environmental; socio-economic and legal-administrational considerations.

The utltimate use of a disposal site is perhaps the most important aspect of a well-planned dredged material containment facility.

CHAPTER III

EXISTING CONDITIONS

Chapter III

EXISTING CONDITIONS

TABLES

FIGURES

ENGINEERING

Historical Dredging

The two major sources of dredged material in Long Island Sound (LIS) are: (1) channel maintenance and construction projects done by the Corps of Engineers; and (2) various dredging/disposal projects done by other governmental agencies and the general public under Federal permits issued by the Corps.

Improvement (new work) dredging, by the Corps of Engineers, in Connecticut harbors has been limited since 1960. They consist of two large volume projects, Bridgeport Harbor in 1962-1963 which generated 2,090,000 cubic yards (cy) and the Connecticut River, an additional 676,000 cy (1963/1965) and two small projects, consisting of a 76,000 cy project in Stony Creek in 1969 and a 31,000 cy job in Niantic Bay and Harbor during 1970. In comparison, the U.S. Navy in New London received a 1974 Federal permit for a deepening project involving 2.8 million cubic yards (MCY) of material.

The Corps of Engineers improvement dredging in New York harbors bordering LIS or the East River has varied widely since 1960. There have been 6 improvement projects undertaken in this period. A total of 2.5 MCY was dredged during the period 1965 through 1968 (147,000 cy at Milton Harbor, 144,000 cy at Marmaroneck, 41,000 cy at Mattetuck Harbor and 2,185,000 cy at Little Neck Harbor. Since then, no improvement dredging has occurred east of the Throgs Neck Bridge while only one, at the East River (825,000 c.y.) in 1974 has been completed. There has been no improvement work since 1960 in Nassau county. Of the 4.5 MCY total for the New York area disposed of in Long Island Sound, about 2.0 MCY, or 45%, was taken from harbors outside LIS.

The Corps maintenance dredging program in Connecticut has been considerably more active than the improvement program, especially in the central coastal area. For the 18-year period 1961 to 1979, Corps total maintenance dredging has been distributed as follows: western coastal area, 871,400 cy; central area, 4,403,500 cy; eastern area, 260,400 cy.

The maintenance dredging program in the New York area has, historically, involved a much greater number of projects than under the improvement program but has resulted in less overall dredged volumes. Since 1960, a total of 600,000 c.y. has been dredged and disposed of an L.I.S. through maintenance as opposed to 4.5 MCY under the improvement program. For the period 1927 - 1979, the Corps total maintenance dredging has been distributed as follows:

Westchester Co.	508,000 cy	13% of total
Nassau Co.	182,000 cy	5% of total
Suffolk Co.	338,000 cy	8% of total
NYC	2,874,000 cy	74% of total
Total	3,902,000 cy	100%

An inventory of dredging/disposal projects done in Connecticut under Federal permit for the 10-year period 1968-1977 can be found in Appendix C of the Reconnaissance Report. Since complete data was only available from 1968 onward, the data was compiled for the period 1968 through 1977.

It must be noted that the permit quantity data are not as reliable as it might seem. There is no simple way to determine how much of the permitted work was actually done and how much material was actually dredged. The permitted yardage has to be taken as the best surrogate for the actual amount dredged and disposed.

For purposes of comparison, over the 10-year period from 1968-1977, non-Corps dredging activity in the entire New York vicinity of Long Island Sound displaced about the same material volume attributable to the Corps, with 2.35 MCY and 2.53 MCY being dredged respectively. Out of the total 2.35 MCY for non-Corps dredging, about 1.2 MCY was dredged from harbors directly located on Long Island Sound. A summary of the permitted dredging disposal activity since 1959 is given in the Interim Report.

This data can be used to identify trends in non-Corps dredging activities. Figure III-1 presents a graph of annual total volumes dredged between 1959 and 1979 for New York harbors directly on Long Island Sound. For new work dredging, there is an obvious and significant trend of decreasing activity over time in each New York county. For maintenance dredging, however, the rate of dredging activity appears to have remained roughly constant over time, with a slight downturn noticeable in the mid to late 1970's, attributable to the closing of the disposal sites.

Dredged Material Disposal

Analysis of the disposal methods data reveals that open water disposal has been perferred in most Federal projects since 1948. The number of active open water disposal sites in Long Island Sound has been reduced from 19 to 4, including Central Long Island Sound, Cornfield Shoals, and New London. The fourth site western Long Island Sound, was opened in 1982. Since 1960, nearly 30 percent of the material dredged from Federal projects was disposed on land, while just over 70% disposed of at open water sites.

Analysis of the disposal methods data of New York reveals that open water disposal has been preferred in most Federal projects in Westchester County, New York City and Nassau county since 1926. Upland disposal had been utilized for these areas only before 1950. In the almost 20-year period from 1961 to 1979, all of the material dredged from Federal

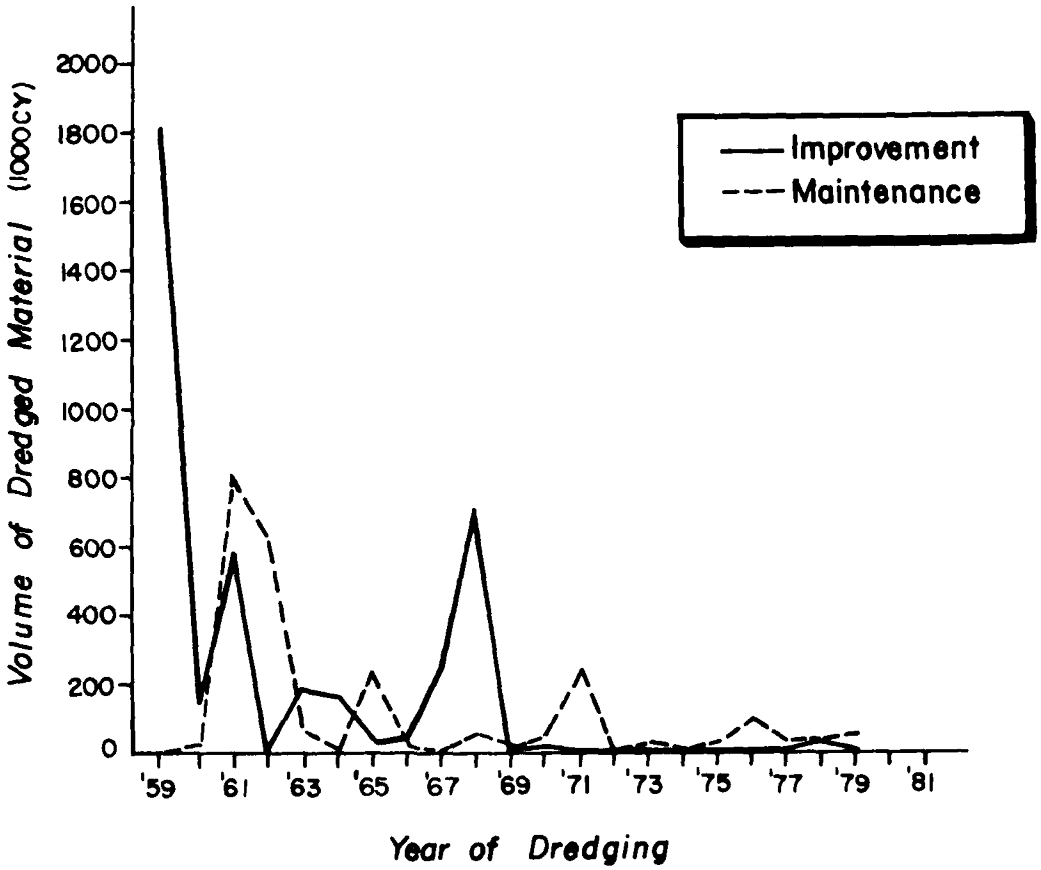


FIGURE III-1 NON-FEDERAL DREDGING IN LIS-NEW YORK (1959-1979)

projects in Westchester County, New York City, and Nassau County was disposed of in open water. Long Island Sound dumping grounds were frequently employed by these Federal projects for open water disposal except for the East River projects and two small O&M jobs which utilized the Mud Dump site in the Atlantic Ocean. Suffolk County has used upland disposal (50% of which is for beach nourishment) since 1927 for all Federal projects except one (Huntington Harbor in 1935) which used open water disposal.

A summary of disposal methods for Corps of Engineers dredging - both O&M and improvement - by state since 1960 is given in Table III-1.

During the data collection phase of this study, an effort was made to determine the historical land disposal sites for each Federal project in the New York study area. Records indicating upland disposal location were very sketchy and incomplete. Five sites, however, have been identified at Westchester Creek, Glen Cove Creek, Huntington Harbor, Northport Harbor, and Mattituck Inlet.

Characteristics of Materials Dredged in LIS Waterways

The observed physical and chemical characteristics of sediments dredged within the harbors bordering LIS vary widely with location and time. Harbor sediments receive contamination from treated and untreated sewage discharges, industrial discharges, oil spills, urban runoff, and river discharges, depending on location. Within any given year, runoff from spring snowmelt or isolated precipitation events can drastically alter the sediment picture. Normal or low flows might be capable of moving only fine-grained particles; but the high discharges during floods can scour a river or estuary bed and transport even coarse-grained material long distances. Chemical/organic characteristics also will vary, but on a more predictable seasonal basis. Fertilizers, herbicides, and pesticides, for example, will be introduced into the sediments via runoff from agricultural areas.

The high variability in DM characteristics within LIS is demonstrated in Tables III-2 to III-5. Table III-2 summarizes results of bulk sediment analysis for sediment samples from Connecticut coastal waterways. As shown, the range of the data is wide for each parameter of interest. Similarly, high variability is observed in Table III-3 for New York waterways. Also shown in Table III-3 is a comparision of bulk sediment analysis for Connecticut and New York areas. The Connecticut mean concentrations of trace metals are consistently much higher than those observed in New York sediments. This is probably due to the greater annual runoff and sediment loads that occur to Connecticut Harbors as opposed to New York Harbors, especially those on the north shore of Long Island where drainage basin size is relatively minor. Table III-4 presents elutriate analysis for a number of New York harbors while Table III-5 contains sediment distribution information in six Long Island north shore harbors. It is difficult to draw firm conclusions or trends from

this very limited data set, but it appears in general that the percentage of coarse sand and gravel in the sediment tends to increase from east to west along the north shore of Long Island. Also, on the average, sediments in Connecticut harbors, are comprised of a much greater percentage of silt and clay when compared to New York harbor sediments. It is stressed that results contained in Tables III-2 to III-5 are based on severely limited data. Only very general trends, as discussed above can be drawn on the basis of these data.

The physical and chemical characteristics of DM determine the marketing potential of the material. The concept of dredged material rehandling has attractive advantages. For example, in certain areas the DM (most likely through some processing) can conserve existing supplies of certain raw materials by serving as a supplemental or replacement source. In such instances, DM products can provide a financial return to partially offset the costs of the disposal operation. Table III-6 is a list of typical major customers for DM products. Marketing potential also makes possible a smaller containment site due to reduced DM quantity. Such a reduction in quantity is important when selecting containment sites, especially when large sites are not available. However, the higher the percentage of fine grained materials present in the dredged material the less likely are the chances of being able to market it.

ECONOMICS

Port Activity

A brief description of social considerations is contained in the subject report immediately following the Environmental Impact Report. Considerable more demographic information is contained in numerous reports mentioned throughout this report. As is true of all major commercial ports in New England, the major imports of the larger commercial ports along the Sound, including Stamford Harbor, Norwalk Harbor, Bridgeport Harbor, the Housatonic River, New Haven Harbor, the Connecticut River (below Hartford), the Thames River, and New London Harbor, are petroleum products. Included in this category are: residual fuel oil for electrical generation and heating of large commercial buildings, schools, and apartment houses; distillate fuel oil, primarily for home heating; and gasoline for automotive use.

Over the most recent decade for which data is available trends in total volume shipped through Long Island Sound ports show a net decrease of 12,130,834 tons (16.8%), with volume peaking in 1973 and declining steadily through 1977 (see Programmatic EIS, Appendix C). During that same period, the only individual ports in Long Island Sound which showed a net increase in total tonnage shipped were New London and Port Jefferson, while net decreases were experienced on the Housatonic River, Norwalk and Stamford Harbors, Port Chester Harbor, East Chester Creek, the Bronx River, West Chester Creek, Flushing Bay and Creek, the Harlem River, the East River, Manhasset Bay, and Hempstead Harbor. All others remained relatively stable in net tonnage shipped.

TABLE III -1

DISPOSAL METHODS FOR CORPS OF ENGINEERS DREDGING IN LONG ISLAND SOUND (1961-1979)

THOUSAND CUBIC YARDS

Coastal Area	Total Volume	Land	%	Water	%
OPERATION AND MAINTENANCE DREDGING					
Connecticut					
Western	871.4	215.0	25	656.4	75
Central	4,403.5	1,410.8	32	2,992.7	68
Eastern	260.4	0	0	260.4	100
Subtotal	5,535.3	1,625.8	29	3,909.5	71
New York					
Westchester Co.	219.2[1]	0	0	219.2[1]	100
New York City					
LIS Harbors	17.5[2]	0	0	17.5[2]	100
East River Harbors	356.4[3]	0	0	356.4[3]	100
Nassau Co.	6.8	0	0	6.8	100
Suffolk Co.	49.8	49.8	100	0	0
Subtotal	649.7	49.8	8	599.9	92
IMPROVEMENT DREDGING					
Connecticut					
Western	2,089.8	675.2	32	1,414.6	68
Central	751.7	139.3	19	612.3	81
Eastern	31.0	0	0	31.0	100
Subtotal	2,872.5	814.5	28	2,057.9	72
New York					
Westchester Co.	291.5	0	0	291.5	100
New York City					
LIS Harbors	2,184.7	0	0	2,184.7	100
East River Harbors	1,985.7[4]	0	0	1,985.7[4]	100
Nassau Co.	0	0	0	0	0
Suffolk Co.	41.0	41.0	100	0	0
Subtotal	4,502.9	41.0	1	4,461.9	99
Connecticut Totals	8,407.8	2,440.3	29	5,967.4	71
New York Totals	5,152.6	90.8	2	5,061.8	98
TOTAL	13,560.4	2,531.1	19	11,029.2	81

[1] Does not include 72.6 disposed of in mud dump.
[2] Does not include 45.2 disposed of in mud dump.
[3] Does not include 755.3 disposed of in mud dump.
[4] Does not include 924.8 disposed of in mud dump.

Table III-2

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE DREDGED MATERIAL FROM CONNECTICUT COASTAL WATERWAYS[a] (BULK ANALYSIS)

PROJECT WATERWAYS ( )†	PHYSICAL PROPERTIES[b,c] SILT & CLAY,%	SAND & GRAVEL,%	METALS[c] PPM A_s	C_d	C_r	C_u	P_b	H_g	N_i	Z_n	V	OTHER ANALYSES[c] PPM OIL & GREASE	COD	TKN	PCB
Brandford Harbor (2,17)	100(C)	--	18.0	2.5	182.3	222.0	95.7	0.52	45.9	506.9	83.3	5080.0	100400.0	2640.0	≈0
Bridgeport Harbor (2,23)	90(C)	10(B)	12.7	6.7	497.0	766.0	239.0	1.10	110.6	551.1	112.8	9232.0	149038.0	4725.0	0.08
Clinton Harbor (2,10)	40(C)	60(A)	7.9	3.9	89.6	173.5	253.5	1.30	56.2	1212.0	90.0	5293.5	115735.0	3264.0	≈0
Connecticut River (7,32)	70(C)	30(B)	5.6	5.0	80.0	96.2	83.3	0.82	58.1	207.6	57.5	2396.0	102480.0	2540.0	0.112
Five Mile River (1,6)	100(C)	--	7.5	7.4	167.2	200.3	29.6	0.68	58.0	304.3	101.3	6988.0	137883.0	4268.0	0.3
Greenwich Harbor (1,6)	100(C)	--	7.8	10.1	137.5	302.9	345.3	1.87	99.4	518.6	133.7	9853.0	200800.0	5968.0	1.6
Guilford Harbor (2,13)	100(C)	--	10.6	3.1	100.0	122.0	76.0	0.41	79.2	223.0	78.0	7782.0	110446.0	3211.0	≈0
Housatonic River (1,14)	10(C)	90(A)	402.7	--*	--	--	62.7	0.15	--	316.5	--	4944.0	220926.0	4207.0	--
Mianus River (1,5)	100(C)	--	18.2	16.0	153.5	305.6	372.6	1.37	110.0	443.0	112.5	5938.0	275825.0	5838.0	--
Milford Harbor (2,12)	75(C)	75(B)	16.9	11.2	202.4	409.0	213.3	1.10	88.4	433.2	77.0	7590.0	187113.0	4774.0	≈0
New Haven Harbor (5,53)	80(C)	20(B)	8.5	3.6	198.0	260.0	136.5	0.82	65.6	306.7	71.1	4413.0	110767.0	4543.0	--
New London Harbor (3,39)	90(C)	10(B)	16.5	6.7	71.2	183.0	1265.0	1.93	67.9	658.8	88.7	6819.0	141659.0	2487.0	--
Thames River (2,17)	75(C)	25(B)	14.9	7.7	241.2	200.2	232.9	1.20	82.9	431.1	163.4	8118.0	238608.0	4435.0	0.65
Niantic Bay (1,7)	15(C)	85(B)	5.6	2.9	66.3	42.9	56.0	0.78	19.0	139.2	42.5	1515.0	57625.0	31180.0	0.3
Norwalk Harbor (4,43)	90(C)	10(B)	9.6	6.84	184.5	360.0	356.6	2.51	89.1	540.8	90.8	11313.0	215770.0	4255.0	--
Stoney Creek (1,3)	100(C)	--	5.2	1.8	61.0	85.3	49.7	0.243	38.5	160.0	62.2	693.0	56833.0	1433.0	0.0001
Westcott Cove	30(C)	70(A)	6.5	8.2	150.0	189.0	115.3	0.75	82.7	256.6	85.8	2886.0	94251.0	2295.0	0.90
Stanford Harbor (4,80)	90(C)	10(B)	14.7	36.4	367.6	1082.5	841.2	3.34	148.4	1630.0	102.7	27055.0	351000.0	8214.0	0.34
Patchogue River (2,14)	75(C)	25(B)	10.7	4.4	131.0	131.2	63.7	0.46	119.7	141.8	108.6	4382.0	131538.0	3665.0	--
Southport Harbor (1,5)	50(C)	50(A)	9.6	3.7	195.2	473.2	341.8	0.6	99.5	244.0	56.1	4505.0	138833.0	3147.0	--
Pawcatuck River (1,14)	70(C)	30(B)	--	--	--	--	215.5	1.61	--	275.9	--	2885.2	341000.0	69060.0	--
Range:			5.2-402.7	1.8-36.4	61.0-497.0	42.9-1082.5	29.6-1265.0	0.15-3.34	19.0-148.4	139.2-1630.0	42.5-163.4	693.0-27055.0	56833.0-351000.0	1433.0-69060.0	0.0-1.6

† (Number of Projects, Number of Samples)

a Data from Corps of Engineers, New England

b (A) Predominantly sands and gravels with less than 20% fines passing the No. 200 sieve with low organic contents,
(B) Predominantly sands and gravels with more than 20% fines passing the No. 200 sieve with minor organic contents, and
(C) Predominantly organic silts and clays.

c Values are averages for individual projects.

* Means N/A

Table III-3

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE DREDGED MATERIAL FROM NEW YORK VICINITY OF LIS (BULK ANALYSIS)

PROJECT WATERWAY ( )[c]	PHYSICAL PROPERTIES SILT & CLAY,%	SAND & GRAVEL,%	METALS PPM A_s	C_d	C_r	C_u	P_b	H_g	N_i	Z_n	OTHERS OIL & GREASE	TOC	PPM PCB
Eastchester Creek * ( )	56.0	44.0	7.2	2.7	79.4	153.8	263.2	1.1	40.1	267.1	5096.0	32500.0	0.1
Mamaroneck Harbor * ( )	79.4	20.6	8.8	2.6	73.7	171.7	226.0	1.3	37.5	308.2	48148.0	35600.0	-[a]
Milton Harbor * ( )	30.3	69.7	0.2	5.7	37.1	158.5	183.7	0.8	51.7	262.5	2483.0	3'700.0	-
Hempstead Harbor (1,3)+	-	-	0.18	0.08	-	14.2	19.0	0.3	-	23.0	417.0	3900.0	-
Centerport Harbor (1,3)+	24.0	76.0	-	5.9	-	91.3	60.5	1.0	-	745.7	-	-	1.0
Old Glen Cove Creek (1,__)+	-	-	-	9.0	132.0	898.0	449.0	-	67.0	299.0	-	-	-
Manhasset Bay (Inner) (1,3)+	-	-	-	2.3	32.0	79.0	210.0	0.13	-	188.0	-	-	-
Mean, New York			4.1	4.0	70.8	224	202	0.8	49.0	299.0	14036.0	26175.0	-
Mean, Connecticut[b]			30.5	7.8	172.4	295.0	259.3	1.12	80.0	452.4	6650	-	0.33
Average Range, New York			0.18 8.8	0.08- 9.0	32.0- 132.0	14.2- 898.0	19.0- 449.0	0.13- 1.3	37.5- 67.0	23.0- 745.7	417.0- 48148.0	3900.0- 36600.0	- -
Average Range, Connecticut[b]			5.2 402.7	1.8- 36 4	61.0- 497.0	42.9- 1082.5	29.6- 1265.0	0.15- 3.34	19.0- 146.4	139.2- 1630.0	693.0- 27055.0	- -	0.0- 1.6

[a]-Indicates Unknown

[b] Source, Table 4.1

[c] (Number of Projects, Number of Samples)

* MITRE (1979)

† Source, Nassau and Suffolk Co., DPW

Table III-4

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE DREDGED MATERIAL FROM NEW YORK VICINITY OF LIS†

(ELUTRIATE TEST)

PROJECT WATERWAY ( )[c]	PHYSICAL PROPERTIES SILT & CLAY,%	SAND & GRAVEL,%	METALS mg/l A_s	C_d	C_r	C_u	P_b	H_g	N_i	Z_n	OTHERS mg/l OIL & GREASE	TOC	PCB
Centerport Harbor (1, 3)	24	76	-[a]	0.04	-	-	-	0.001	-	-	-	-	0.001
Northport Harbor (1, -)	80	20	0.02	0.1	0.1	0.6	0.1	0.001	0.1	0.2	-	-	1.0
Nissequogue River (1, -)	2	98	0.02	0.1	0.1	-	0.5	*	0.1	0.2	-	-	-
Porpoise Channel (1, -)	*	100	0.02	0.1	0.1	0.1	0.5	*	0.25	0.25	-	-	-
Stony Brook Harbor (1, -)	*	100	0.02	0.1	0.1	0.1	0.5	*	0.25	0.25	-	-	-
Manhasset Bay (Outer) (1, 3)	-	-	0.002	0.001	0.01	0.003	0.01	*	0.025	0.01	-	-	-
Hempstead Harbor (1, 3)	-	-	0.002	0.001	0.005	0.004	0.008	*	0.006	0.003	-	-	-
Glen Cove Cr. (1,2)	-	-	0.002	0.021	0.05	0.083	0.143	0.004	0.115	0.052	36.0	-	-
Mean			0.012	0.008	0.07	0.15	0.25	-	0.12	0.14	-	-	-
Average Range			0.002-0.02	0.001-0.1	0.005-0.1	0.003-0.6	0.008-0.5	-	0.006-0.25	0.003-0.25	-	-	-

[a]- Indicates Unknown

[c] (# of Projects, # of samples)

* Insignificant

† Source, Suffolk Co. DPW and Nassau Co. DPH

Table III-6

Potential Major Customers For
Dredged Material Products

Customer	Typical Needs
Raw material suppliers (sand and gravel mining and processing operations)	Material needs dictated by consumer being served. Requirements might be as simple as clean, organically-free material; or as stringent as separated coarses with a particular grain-size cutoff.
Developers, construction firms	Landfill (classified and unclassified) subsidence fill, road embankments, earthfill dams, levees, shoreline restoration, aesthetic treatments (mounding, soil conditioner).
Mining industry	Fill and nutrient-rich cover for strip mines, quarries, underground mines.
Highway departments	Material for road base; fill for embankments; sand to spread on icy roads.
Asphalt and concrete plants	Sand for portland cement and asphaltic concrete mixes.
Solid waste agencies and private firms	Cover for sanitary landfill operations.
Environmental organizations and agencies (Corps, State environmental and natural resources bodies)	Material for wildlife habitat creation (wetlands, bird island).
Recreation agencies (local parks and recreation departments, Corps)	Fill for parkland development; beach nourishment.
Agricultural interests	Soil conditioner, nutrient-rich cover; fill for erosion-prone fields and streambanks.

(after Raster, et al. (1978))

These overall trends become more meaningful when analyzed on a commodity by commodity basis. The major receipts at six of the eight commercial ports in Connecticut is residual fuel oil, the total volume of which has declined by approximately one million short tons since 1969. Shipments of residual peaked in 1973 at almost double the level of 1977. Individual ports experiencing a slight net decline in residual shipments were New London, the Connecticut River, New Haven Harbor, and Bridgeport Harbor with Stamford Harbor showing a more significant net decline. Those ports for which a net increase in residual shipments is witnessed, including the Thames River, the Housatonic River, and Norwalk Harbor, do so because of the widespread substitution of petroleum for coal. It must be recognized that in each of these ports, a net decline in residual has actually occurred since the time of that substitution.

Distillate fuel oil ranks second in quantity received by the majority of ports along Long Island Sound, and appears to be following a declining trend similar to that described for residual. Overall, Connecticut ports reduced their distillate shipments over the period 1969-1977, by approximately one million short tons. Slight increases in net tonnage shipped occurred at New London, the Thames River, and Norwalk, with a significant decrease recorded on the Connecticut River and Bridgeport, and slight decreases at New Haven and Stamford. Very little distillate has been shipped over the Housatonic River since 1969.

The third major commodity shipped over Long Island Sound, gasoline, has shown an overall net increase over the last decade of approximately one million short tons, peaking in the most recent year for which data is available, 1977. The significant increases in gasoline receipts recorded at New Haven, Bridgeport, and the Thames River have been somewhat offset by substantial decreases at New London, Stamford, and the Connecticut River.

Three other major commodities shipped through Long Island Sound and considered major receipts at several Connecticut ports are: sand, gravel and crushed stone; chemicals and chemical products; and iron and steel scrap. Imports of sand, gravel and crushed stone have declined over the last decade, a trend particularly prominent between 1969 and 1971. Although an overall net decline has been experienced at each individual port, growth and decline on a year-to-year basis has been very erratic.

Receipt of chemicals and chemical products has increased in Connecticut ports as a whole, largely due to greater quantities shipped through the Thames River and New London Harbor. Total tonnage of chemicals shipped through New Haven has remained relatively constant, as has a relatively insignificant quantity at Bridgeport Harbor.

Shipments of iron and steel scrap from Long Island Sound ports have decreased substantially since 1969, of particular significance at New Haven and Bridgeport Harbors. This decreasing trend is reportedly the result of poor domestic market conditions and the inability of American

exporters to compete with foreign exporters in foreign markets, and not due to lack of supply or inadequate port conditions.

At the present time, no container port facilities have been developed in any of the major commerical ports on Long Island Sound.

In addition to the commercial activity described, recreational activity along the Sound has been increasing rapidly over recent decades. Powerboating, sailing, and fishing (for sport and profit) are prevalent along the entire shoreline of the Sound. Major recreational ports included in the Western Coastal Area of Connecticut are: Greenwich Harbor, the Mianus River, Westcott Cove, Fivemile River Harbor, Westport Harbor and the Saugatuck River, and Southport Harbor. The Central Coastal area includes: Milford Harbor, Branford Harbor, Stony Creek Harbor, Guilford Harbor, Clinton Harbor, Duck Island Harbor, and the Patchogue River. The Eastern Coastal Area includes the following small boat ports: Niantic Bay, Mystic River, Stonington Harbor, and the Pawcatuck River. Each of these harbors is used extensively during peak summer months and is currently subject to growth pressure. Most private and public yacht clubs and marinas throughout the Sound region are filled to capacity and report waiting lists for moorings and dock facilities.

Dredged Material Disposal Costs

The most frequently employed method of dredged material disposal is open water disposal; dumping of dredged material on the sea bottom in areas distant from the shore and remaining submerged at all times. For the past 10 years the only active disposal sites in LIS were New Haven, Cornfield Shoals, and New London. A fourth, WLIS III, was designated for use in March 1982.

The unit transportation costs ($/cy/mile) of open water disposal are a function of the type of equipment used: sizes of the barge and tug, towing speed, number of barges towed, and accompanying capital and operating cost. The unit transport costs are generally constant up to a distance of approximately 15 miles at which point the costs begin to increase due to overtime costs and the greater likelihood that adverse weather will inhibit dumping activities. Table III-7 shows the unit costs of open water disposal by the Corps of Engineers.

The primary determinant of unit dredging costs is the ability to maintain continuous operation of the dredge. Longer hauling distances would increase unit dredging costs as additional tugs and barges are required to keep a dredge in continuous operation. A longer round trip time greatly reduces the number of daily trips a tug and barge can make to the disposal site. This in turn requires the presence of additional tugs and barges to provide additional carrying capacity. The net result is that capital and operating costs must go up, or if additional equipment is not available, productivity diminishes while the dredge idles until a barge becomes available.

TABLE III-7

VOLUME AND COST ESTIMATES OF DREDGED MATERIAL OCEAN DUMPED
BY THE U.S. ARMY CORPS OF ENGINEERS IN 1975

DIVISION	TOTAL VOLUME DREDGED (1000 cy)	TOTAL VOLUME OCEAN DUMPED (1000 cy)	PERCENT OCEAN DUMPED	AVERAGE UNIT COST*	TOTAL COST
New England	874	551	63	$8.04	$ 4,430
North Atlantic	24,856	10,500	42	1.66	17,430
South Atlantic	67,095	11,360	17	.89	10,110
Lower Mississippi	167,030	33,508	20	.29	9,717
South Western	(8,485)	8,581	100	1.19	10,211
South Pacific	47,394	2,516	5	.53	1,333
North Pacific	21,213	7,474	35	.64	4,783
Total	336,947	74,490**	22	$ .78	$58,014

* Using division average, their crude estimate of cost of ocean dumping.

** Excluding Hawaii with 30,000 cubic yards.

(8,485) Figure appears to be in error in source document.

The unit transportation cost for a commonly employed tug/barge combination has been estimated at 6.2¢/cubic yard/mile (PEIS, 1981). Assuming the use of an 1800 hp tug towing one 2000 cubic yard hopper barge at 6 statute miles per hour. The mileage refers to one way distance to a disposal site, but allows for the round trip distance.

Changes in unit dredging costs as affected by change in the transportation component will affect two primary sectors in the study area, the small local marine trade and the firms involved in waterborne commerce. The small local marine trade firms include marinas, recreational boating dealers, and local dredging firms. Organizations engaged in waterborne commerce include terminal companies, shippers, petroleum storage and distribution firms, and municipal port authorities. Both of the above sectors are dependent upon periodic dredging, either by private means or the Corps of Engineers, to help maintain the economic viability of their operations.

The use of the present three disposal sites in Long Island Sound has had an adverse economic impact on water-oriented businesses that depend upon periodic maintenance dredging for their economic viability. The closing of some of the historic dumping areas in the Sound, has contributed to the decline in economic viability of the boating industry in Connecticut in recent years in spite of the increase in recreational boating demand.

The closing of historic disposal areas in the Sound and the use of the current regional disposal sites has also had an adverse impact on small local dredging companies in the Long Island Sound area. The increased haul distance to disposal areas has decreased the competitiveness of the small dredging company that do not have the additional equipment necessary to keep their dredges in continuous operation. Similarly, the small pieces of equipment needed to service the small harbor and marinas along the coast are generally not capable of capturing economies of scale in transporting the material and their unit dredging costs have risen significantly. Small operators have lost revenues as marinas have found maintenance dredging too costly to do as frequently as they have in the past.

CHAPTER IV

PROBLEMS, NEEDS & OPPORTUNITIES

Chapter IV

PROBLEMS, NEEDS AND OPPORTUNITIES

TABLES

PLATES

PROJECTIONS OF DREDGED MATERIAL QUANTITIES

Future dredging requirements at Long Island Sound ports depend largely on the level of future port activity. Changing conditions in type and level of activity determine the need for channel improvements, as well as for maintenance dredging by the Federal Government. A large amount of dredging by non-Federal sources is also common at dockside and between the dock and Federal Channel, at private marinas and yacht clubs, and beyond the limits of Federal channels and anchorages.

Projections of future quantities to be dredged from these harbors as Federal maintenance projects are expressed in ranges corresponding to the Minimum Growth Minimum Change, the Most Probable Future, and the Maximum Growth/Maximum Change Scenarios, as illustrated by coastal area and port in Tables IV-1, IV-2 and IV-3, respectively and Plates IV-1 through IV-5. Total quantities calculated on these tables are based on the historical dredging needs of individual ports and anticipated future trends under three different growth conditions. Minimum growth means that funding for maintenance would be scarce over the 50-year study period and that most ports would be dredged only when navigation on their channels was actually impeded. In the Most Probable Future Scenario, funds would be allocated for individual port maintenance at approximately the same intervals as they have in the past, with an emphasis on regular maintenance of large commercial ports. The Maximum Growth Scenario would assume that funds would actually be available to maintain all ports at regular intervals to their optimal condition.

Projected non-Corps dredging along Long Island Sound is more difficult to establish because it is beyond the realm of Federal planning, and would become highly speculative, if not impossible, on a port-by-port basis. It appears to be a reasonable assumption that dredging by permit will continue at approximately the same rate as it has in the past, excluding consideration of the two major U.S. Navy dredging projects at New London Harbor in recent years. A Minimum Growth Scenario would occur for non-Corps dredging if the recreational boating industry lagged, if proposed improvement work or Federal maintenance work that would spur private dock owners to deepen or widen their own channel were not implemented, if disposal sites are unavailable, or if waterborne commerce becomes outmoded due to changes in New England's economic base. Under such conditions, it has been approximated for the purposes of this report that non-Corps dredging in the future would exist at a rate 20 percent below current levels.

On the other hand, if significant improvements either currently proposed or not yet proposed are implemented by the Federal Government, private interests may be encouraged to match the improved conditions at their own dock facilities, thus resulting in a larger quantity of dredge material. Additional conditions favorable to future project developments such as continued rapid growth of the recreational boating industry, continued expansion of the commercial fishing industry as a result of the

200 mile limit on territorial waters, and the establishment of waterborne commerce as the most economical mode of transport due to increased costs of alternatives, may also result in an increased future rate of private dredging initiatives. For purposes of this study, the Maximum Growth Scenario assumes an increased future rate of non-Corps dredging to approximately 20 percent greater than current levels. Projected quantities of dredged material under all three scenarios are shown in Table IV-4 for each of the three coastal areas and for Connecticut as a whole.

Several proposed navigation improvements along Long Island Sound were taken into consideration in projecting future Federal improvement dredging quantities. The minimum growth scenario, as previously described, would limit future improvement work to a few currently proposed small boat harbor projects plus a minimal amount of dredging not currently proposed, estimated at 200,000 cubic yards (c.y.) in each coastal area. A total of 1,010,000 c.y. of dredge material in the three Connecticut areas is outlined in Table IV-5.

Quantities of future dredged material resulting from Federal improvements associated with the Most Probable Future and Maximum Growth Scenarios are presented by port and coastal area in Tables IV-6 and IV-7 respectively. Both scenarios are based on the assumption that all proposals currently under consideration will actually be implemented and the specific quantities associated with them will require new disposal sites. The major difference between the two scenarios is that an additional 300,000 c.y. of material per coastal area is estimated for projects not yet proposed under the Most Probable Future, and an additional 500,000 c.y. per coastal area under Maximum Growth conditions.

Total anticipated quantities of dredged materials resulting from all categories of dredging activity over the study period for each possible future scenario defined are summarized by Table IV-8. Although the total range from minimum to maximum quantities is broad, approximately 33 MCY c.y. of material compared with 61 MCY, the estimates must reflect the need for flexible planning over a period of 50 years due to the transitional nature of port activity in the Long Island Sound region and the unpredictable nature of the primary channel use in major commercial ports.

CONDITIONS IF NO FEDERAL ACTION TAKEN

The problem of finding environmentally acceptable, economical means of disposing of dredged material can have serious effects on the region's economy. If dredging is not performed periodically due to the lack of disposal sites it would eventually result in the silting in of the authorized channels; limiting or terminating access to the port facilities.

As existing disposal sites approach capacity, the necessity for development of new feasible solutions to the anticipated future disposal

TABLE IV-1

PROJECTED FEDERAL MAINTENANCE DREDGING
MINIMUM GROWTH SCENARIO - 1985-2035

Coastal Area	Project	Number Projects	Ave.Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Western	Greenwich Harbor	1	50,000	1,000	50,000
Connecticut	Mianus River	1	35,000	700	35,000
Coastal	Stamford Harbor	1	100,000	2,000	100,000
Area	Westcott Cove	1	20,000	800	20,000
	Fivemile River Harbor	2	70,000	2,800	140,000
	Norwalk Harbor	7	150,000	18,000	1,050,000
	Westport Harbor & Saugatuck River	2	35,000	1,400	70,000
	Southport Harbor	2	50,000	2,000	100,000
	Bridgeport Harbor	8	275,000	44,000	1,925,000
	Housatonic River	4	200,000	16,000	800,000
	Total			88,700	4,290,000
Central	Milford Harbor	3	40,000	2,400	120,000
Connecticut	New Haven Hbr	17	225,000	76,500	3,825,000
Coastal	Branford Harbor	4	100,000	8,000	400,000
Area	Stony Creek Harbor	1	35,000	1,400	35,000
	Guilford Harbor	3	80,000	4,800	240,000
	Clinton Harbor	5	30,000	3,600	150,000
	Duck Is. Harbor	1	100,000	2,000	100,000
	Patchogue River	5	50,000	6,000	250,000
	Conn. River (Below Harbor)	22	200,000	80,000	4,400,000
	Total			184,700	9,520,000
Eastern	Niantic Bay				
Connecticut	& Harbor	1	40,000	1,600	40,000
Coastal	Thames River	4	200,000	12,000	800,000
Area	New London Harbor	0	--	--	0
	Mystic River	1	25,000	500	25,000
	Stonington Harbor	0	--	--	0
	Pawcatuck River	3	25,000	1,500	75,000
	Total			15,600	940,000

TABLE IV-1 (Cont'd)

Coastal Area	Project	Number Projects	Ave.Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Westchester County	Port Chester	4	40,000	3,200	160,000
	Milton	0	-	-	-
	Mamaroneck	4	30,000	2,400	120,000
	Echo	0	-	-	-
	New Rochelle	1	30,000	600	30,000
	Total			6,200	310,000
Nassau County	Hempstead	2	40,000	1600	80,000
	Glen Cove Creek	2	20,000	800	40,000
	Total			2,400	120,000
Suffolk	Huntington	1	12,000	240	12,000
	Port Jefferson	0	-	-	-
	Mattituck		35,000	3,500	175,000
	Total			3,740	187,000
New York City	East Chester	4	35,000	2,800	140,000
	West Chester	6	120,000	14,400	720,000
	Bronx River	6	70,000	8,400	420,000
	Flushing Bay & Creek	3	110,000	6,600	330,000
	Harlem River	4	40,000	3,200	160,000
	East River	4	40,000	3,200	160,000
	Total			38,600	1,930,000
Total Long Island Sound				339,940	17,297,000

TABLE IV-2

PROJECTED FEDERAL MAINTENANCE DREDGING
MOST PROBABLE FUTURE SCENARIO--1985-2035

Coastal Area	Project	Number Projects	Ave. Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Western Coastal Area	Greenwich Harbor	2	50,000	2,000	100,000
	Mianus River	2	35,000	1,400	70,000
	Stamford Harbor	2	100,000	5,000	200,000
	Westcott Cove	3	20,000	1,200	60,000
	Fivemile River Hbr.	2	70,000	4,200	140,000
	Norwalk Harbor	9	150,000	21,000	1,350,000
	Westport Harbor & Saugatuck River	2	35,000	2,100	70,000
	Southport Harbor	3	50,000	3,000	150,000
	Bridgeport Harbor	9	275,000	55,000	2,475,000
	Housatonic River	5	200,000	20,000	1,000,000
	Total			112,900	5,615,000
Central Coastal Area	Milford Harbor	6	40,000	4,800	240,000
	New Haven Harbor	22	225,000	99,000	4,950,000
	Branford Harbor	5	100,000	10,000	500,000
	Stony Creek Harbor	2	35,000	2,100	70,000
	Guilford Harbor	3	80,000	6,400	240,000
	Clinton Harbor	6	30,000	4,200	180,000
	Duck Is. Harbor	2	100,000	4,000	200,000
	Patchogue River	7	50,000	7,000	350,000
	Conn. River (Below Hartford)	28	200,000	100,000	5,600,000
	Total			241,500	12,330,000
Eastern Coastal Area	Niantic Bay & Harbor	2	40,000	2,400	80,000
	Thames River	6	200,000	16,000	1,200,000
	New London Harbor	2	100,000	10,000	200,000
	Mystic River	2	25,000	1,000	50,000
	Stonington Harbor	0	--	--	--
	Pawcatuck River	4	25,000	2,000	100,000
	Total			31,400	1,630,000

TABLE IV-2 (Cont'd)

Coastal Area	Project	Number Projects	Ave.Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Westchester County	Port Chester	5	40,000	4,000	200,000
	Milton	0	-	-	-
	Mamaroneck	5	30,000	3,000	150,000
	Echo	0	-	-	-
	New Rochelle	2	30,000	1,200	60,000
	Total			8,200	410,000
Nassau County	Hempstead	3	40,000	2,400	120,000
	Glen Cove Creek	3	20,000	1,200	60,000
	Total			3,640	180,000
Suffolk County	Huntington	1	12,000	240	12,000
	Port Jefferson	1	35,000	700	35,500
	Mattituck	8	35,000	5,600	280,000
	Total			6,540	327,000
New York City	East Chester	5	35,000	3,500	175,000
	West Chester	8	120,000	19,200	960,000
	Bronx River	7	70,000	9,800	490,000
	Flushing Bay & Creek	4	110,000	8,800	440,000
	Harlem River	5	40,000	4,000	200,000
	East River	5	40,000	4,000	200,000
	Total			49,300	2,505,000
Total Long Island Sound				456,380	22,997,000

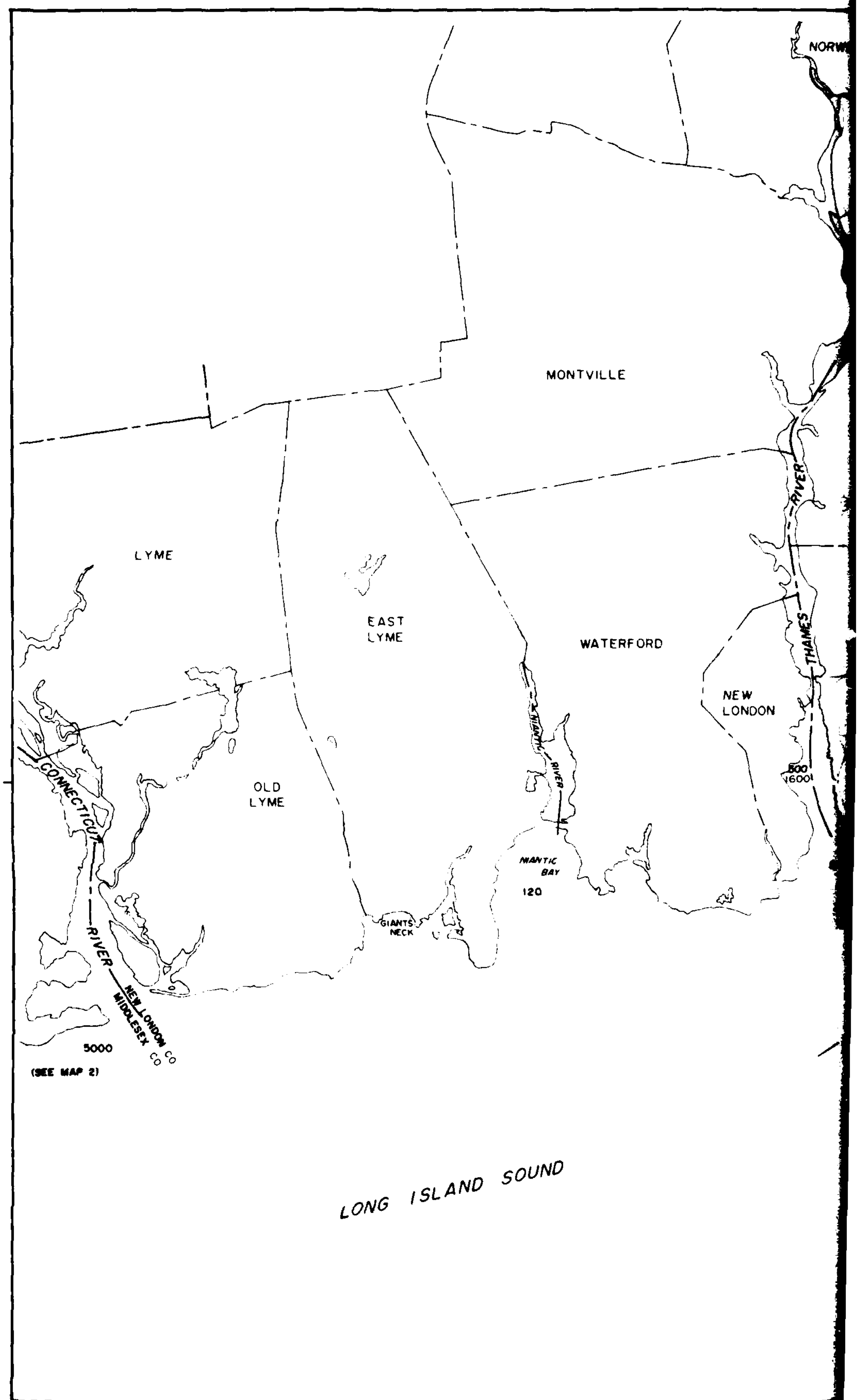
TABLE IV-3

PROJECTED FEDERAL MAINTENANCE DREDGING
MAXIMUM GROWTH SCENARIO--1985-2035

Coastal Area	Project	Number Projects	Ave.Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Western Coastal Area	Greenwich Harbor	3	50,000	3,000	150,000
	Mianus River	3	35,000	2,100	105,000
	Stamford Harbor	3	100,000	6,000	300,000
	Westcott Cove	4	20,000	1,600	80,000
	Fivemile River Hbr.	4	70,000	5,600	280,000
	Norwalk Harbor	8	150,000	24,000	1,200,000
	Westport Harbor & Saugatuck River	4	35,000	2,800	140,000
	Southport Harbor	4	50,000	4,000	200,000
	Bridgeport Harbor	12	275,000	66,000	3,300,000
	Housatonic River	6	200,000	20,000	1,200,000
	Total			139,100	6,955,000
Central Coastal Area	Milford Harbor	5	40,000	4,000	200,000
	New Haven Harbor	23	225,000	103,500	5,175,000
	Branford Harbor	6	100,000	12,000	600,000
	Stony Creek Harbor	4	35,000	2,800	140,000
	Guilford Harbor	5	80,000	8,000	400,000
	Clinton Harbor	8	30,000	4,800	240,000
	Duck Is. Harbor	3	100,000	6,000	300,000
	Patchogue River	8	50,000	8,000	400,000
	Conn. River (Below Hartford)	33	200,000	108,000	5,400,000
	Total			257,100	12,855,000
Eastern Coastal Area	Niantic Bay & Harbor	4	40,000	3,200	160,000
	Thames River	5	200,000	20,000	1,000,000
	New London Harbor	5	100,000	10,000	500,000
	Mystic River	3	25,000	1,500	75,000
	Stonington Harbor	--	--	--	--
	Pawcatuck River	5	25,000	2,500	125,000
	Total			37,200	1,860,000

TABLE IV-3 (Cont'd)

Coastal Area	Project	Number Projects	Ave. Vol. Per Project	Average Annual Volume	50-Year Cumulative Quantity
Westchester County	Port Chester	5	40,000	4,000	200,000
	Milton	1	50,000	1,000	50,000
	Mamaroneck	6	30,000	3,600	180,000
	Echo	1	10,000	200	10,000
	New Rochelle	3	30,000	1,800	90,000
	Total			10,600	530,000
Nassau County	Hempstead	4	40,000	3,200	160,000
	Glen Cove Creek	3	20,000	1,200	60,000
	Total			4,400	220,000
Suffolk County	Huntington	2	12,000	480	24,000
	Port Jefferson	1	35,000	700	35,000
	Mattituck	10	35,000	7,000	350,000
	Total			8,180	409,000
New York City	East Chester Creek	5	35,000	3,500	175,000
	West Chester Creek	10	120,000	24,000	1,200,000
	Bronx River	8	70,000	11,200	560,000
	Flushing Bay & Creek	4	110,000	8,800	440,000
	Harlem River	7	40,000	5,600	280,000
	East River	7	40,000	5,600	280,000
	Total			58,700	2,935,000
Total Long Island Sound				515,280	25,764,000



NORW
MONTVILLE
LYME
EAST
LYME
WATERFORD
NEW
LONDON
OLD
LYME
CONNECTICUT
RIVER
THAMES
RIVER
NIANTIC
RIVER
NIANTIC
BAY
120
GIANTS
NECK
500
600
NEW LONDON CO
MIDDLESEX CO
5000
(SEE MAP 2)
LONG ISLAND SOUND

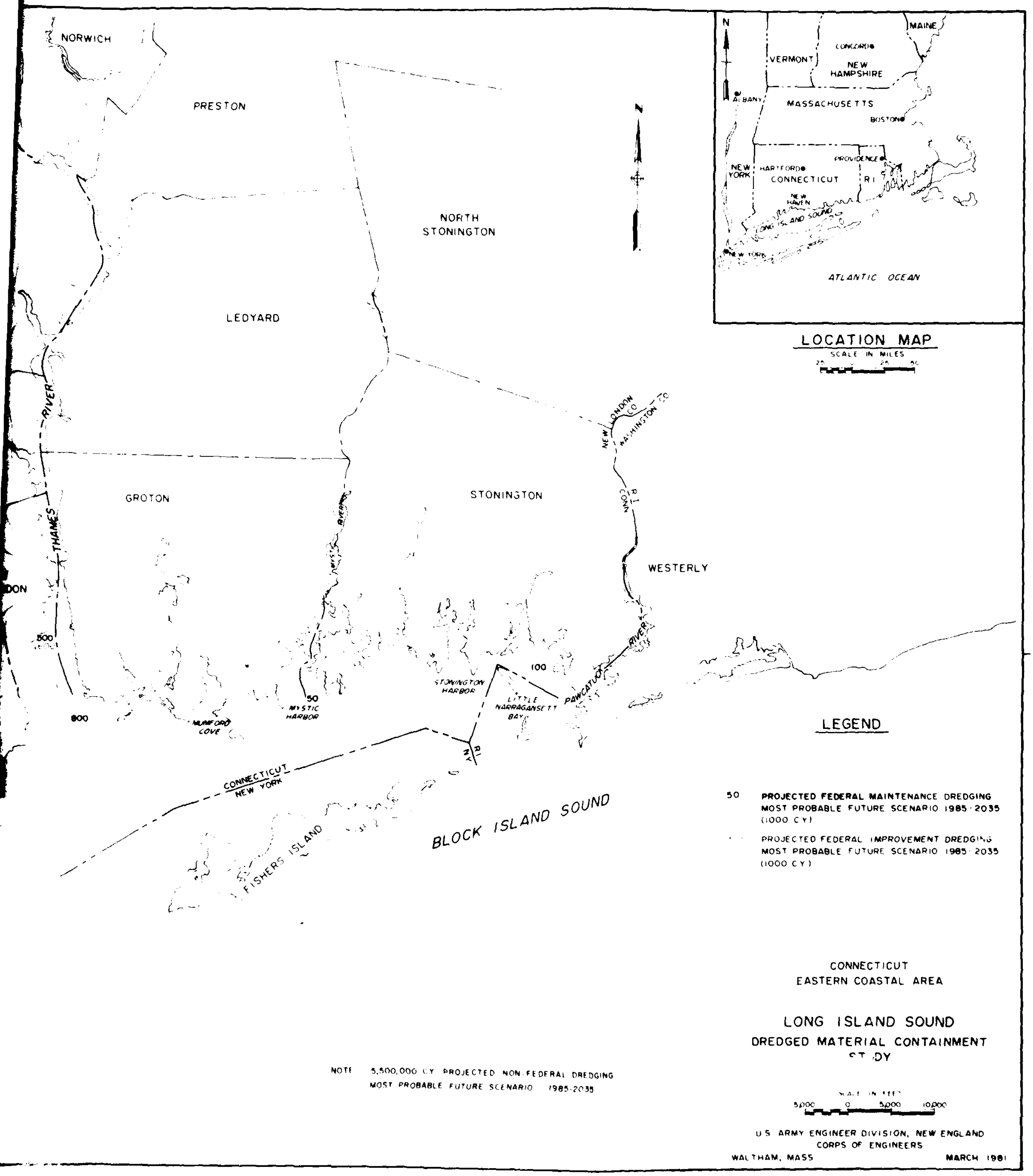
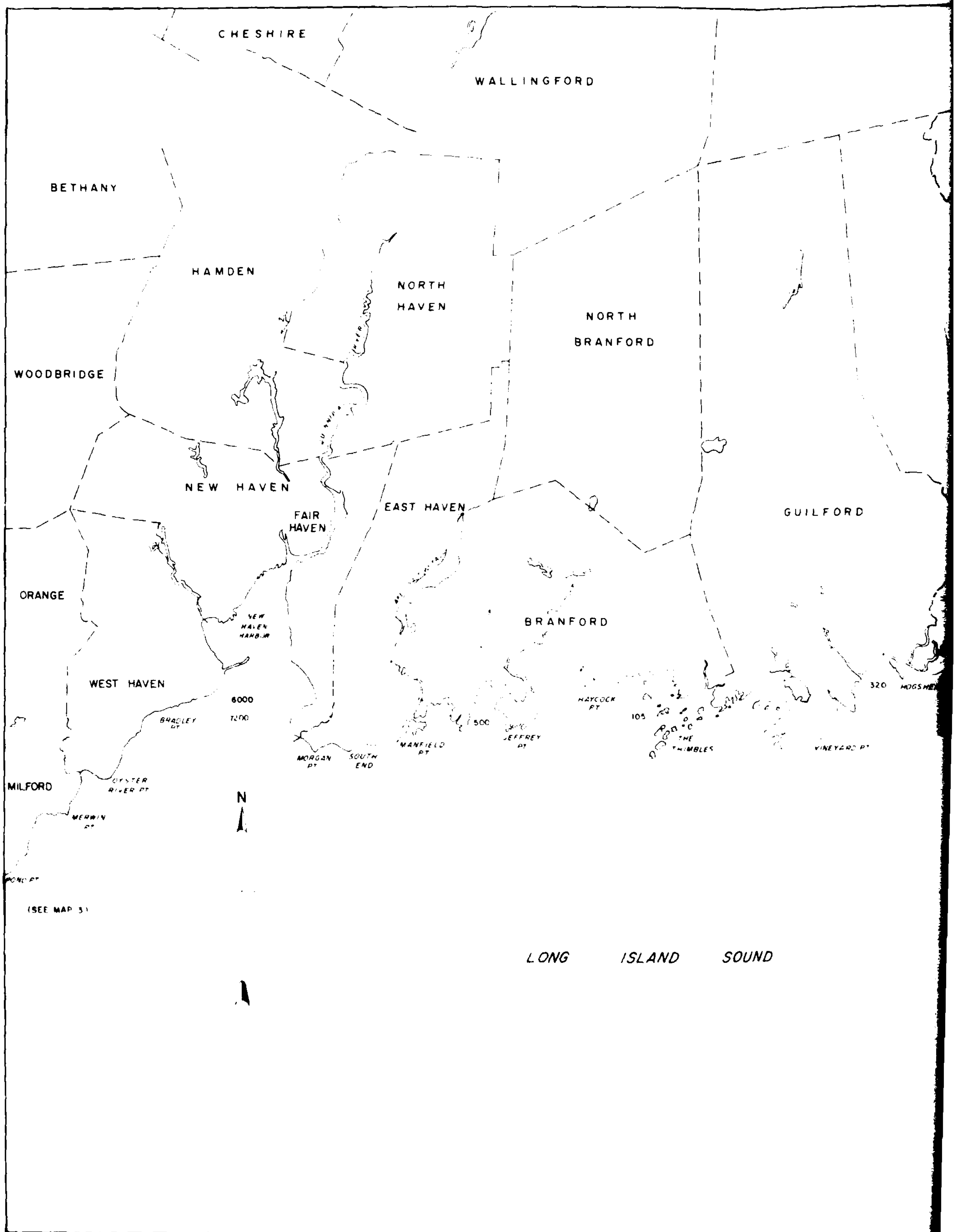
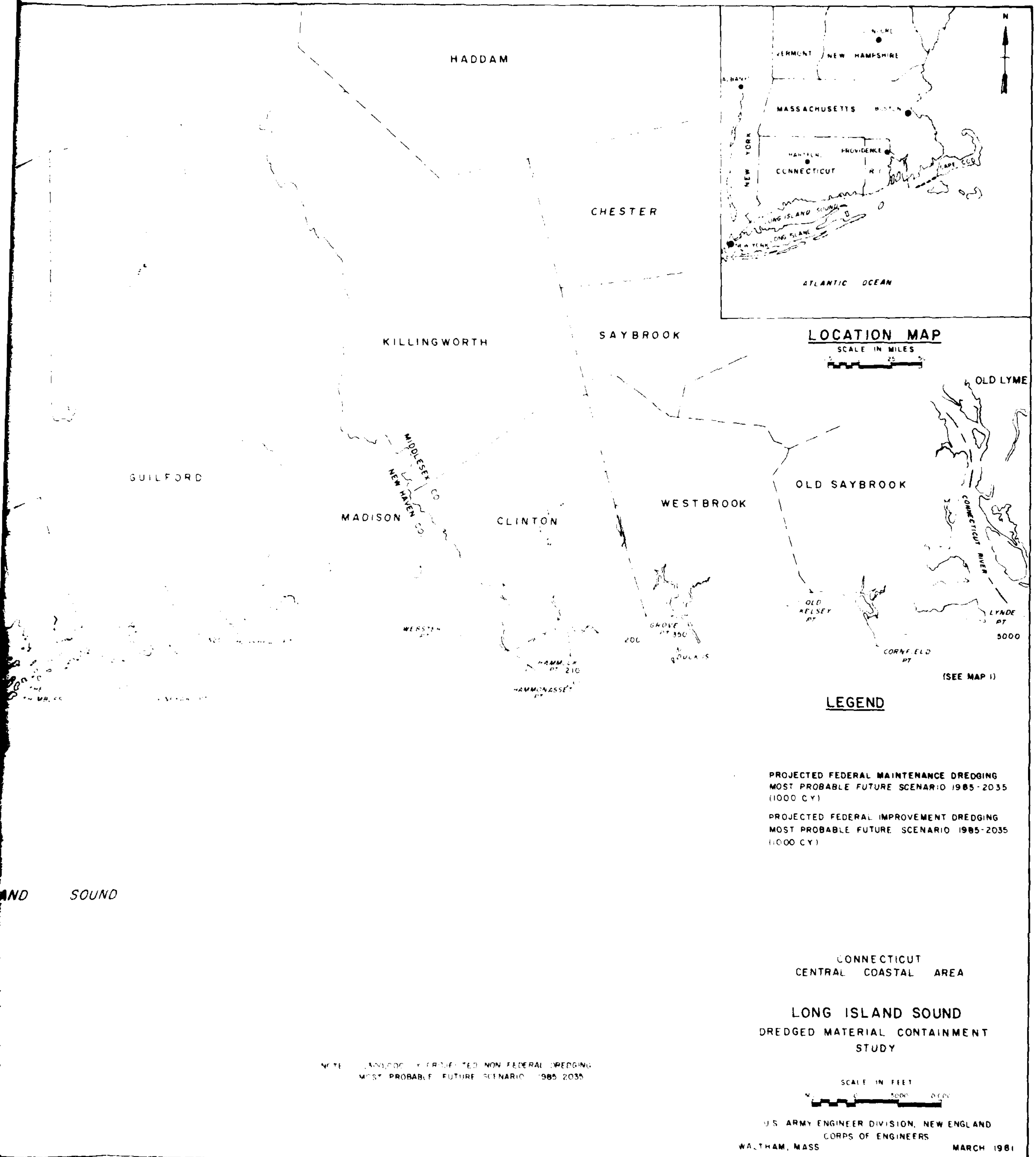

NORWICH
PRESTON
NORTH STONINGTON
LEDYARD
GROTON
STONINGTON
WESTERLY
THAMES RIVER
MYSTIC RIVER
PAWCATUCK RIVER
NEW LONDON CO
WASHINGTON CO
R.I. CONN
500
800
50
100
MUMFORD COVE
MYSTIC HARBOR
STONINGTON HARBOR
LITTLE NARRAGANSETT BAY
CONNECTICUT
NEW YORK
R.I. N.Y.
BLOCK ISLAND SOUND
FISHERS ISLAND
N
MAINE
VERMONT
CONCORD
NEW HAMPSHIRE
ALBANY
MASSACHUSETTS
BOSTON
NEW YORK
HARTFORD
CONNECTICUT
PROVIDENCE
R.I.
NEW HAVEN
LONG ISLAND SOUND
NEW YORK
ATLANTIC OCEAN
LOCATION MAP
SCALE IN MILES
LEGEND
50 PROJECTED FEDERAL MAINTENANCE DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 C.Y.)
PROJECTED FEDERAL IMPROVEMENT DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 C.Y.)
CONNECTICUT
EASTERN COASTAL AREA
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY
NOTE 5,500,000 C.Y. PROJECTED NON-FEDERAL DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035
SCALE IN FEET
5,000 0 5,000 10,000
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
MARCH 1981

Plate IV-1

2



CHESHIRE
WALLINGFORD
BETHANY
HAMDEN
NORTH HAVEN
NORTH BRANFORD
WOODBRIDGE
NEW HAVEN
FAIR HAVEN
EAST HAVEN
GUILFORD
ORANGE
BRANFORD
WEST HAVEN
6000
7200
BRADLEY PT
HAYCOCK PT
105
THE THIMBLES
500
JEFFREY PT
MANFIELD PT
MORGAN PT
SOUTH END
320
VINEYARD PT
MILFORD
OYSTER RIVER PT
MERWIN PT
N
(SEE MAP 3)
LONG ISLAND SOUND



LOCATION MAP

SCALE IN MILES

(SEE MAP 1)

LEGEND

PROJECTED FEDERAL MAINTENANCE DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 CY)

PROJECTED FEDERAL IMPROVEMENT DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 CY)

NOTE: PROJECTED NON FEDERAL DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035

CONNECTICUT
CENTRAL COASTAL AREA

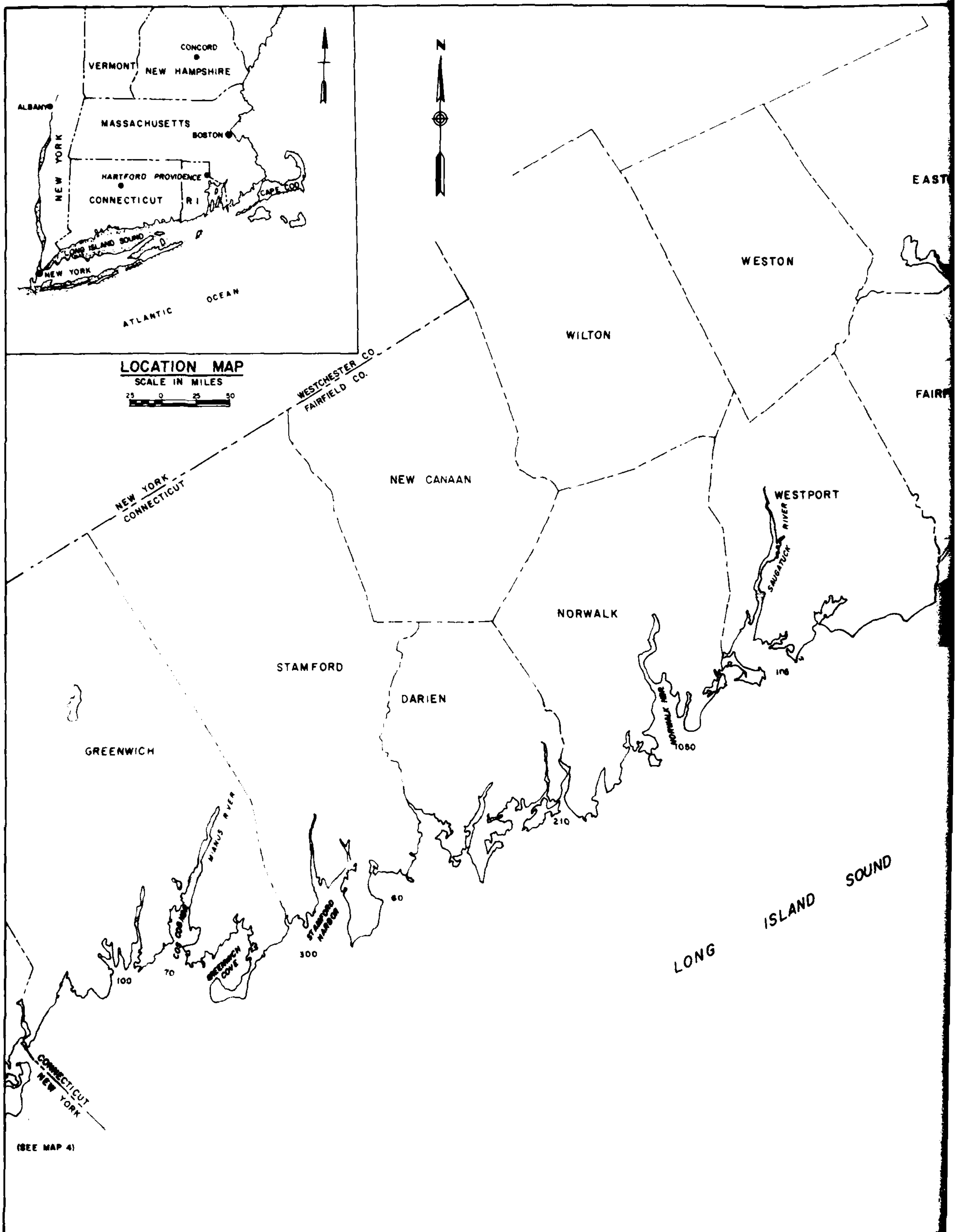
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY

SCALE IN FEET

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS MARCH 1981

Plate IV-2

2



VERMONT
NEW HAMPSHIRE
CONCORD
ALBANY
MASSACHUSETTS
BOSTON
NEW YORK
HARTFORD
PROVIDENCE
CONNECTICUT
R I
CAPE COD
LONG ISLAND SOUND
NEW YORK
ATLANTIC OCEAN
LOCATION MAP
SCALE IN MILES
25 0 25 50
N
WESTCHESTER CO.
FAIRFIELD CO.
NEW YORK
CONNECTICUT
WILTON
WESTON
NEW CANAAN
WESTPORT
SAUGATUCK RIVER
NORWALK
NORWALK RIVER
STAMFORD
DARIEN
GREENWICH
MIANUS RIVER
GREENWICH COVE
STAMFORD HARBOR
100
70
300
60
210
1080
LONG ISLAND SOUND
CONNECTICUT
NEW YORK
(SEE MAP 4)

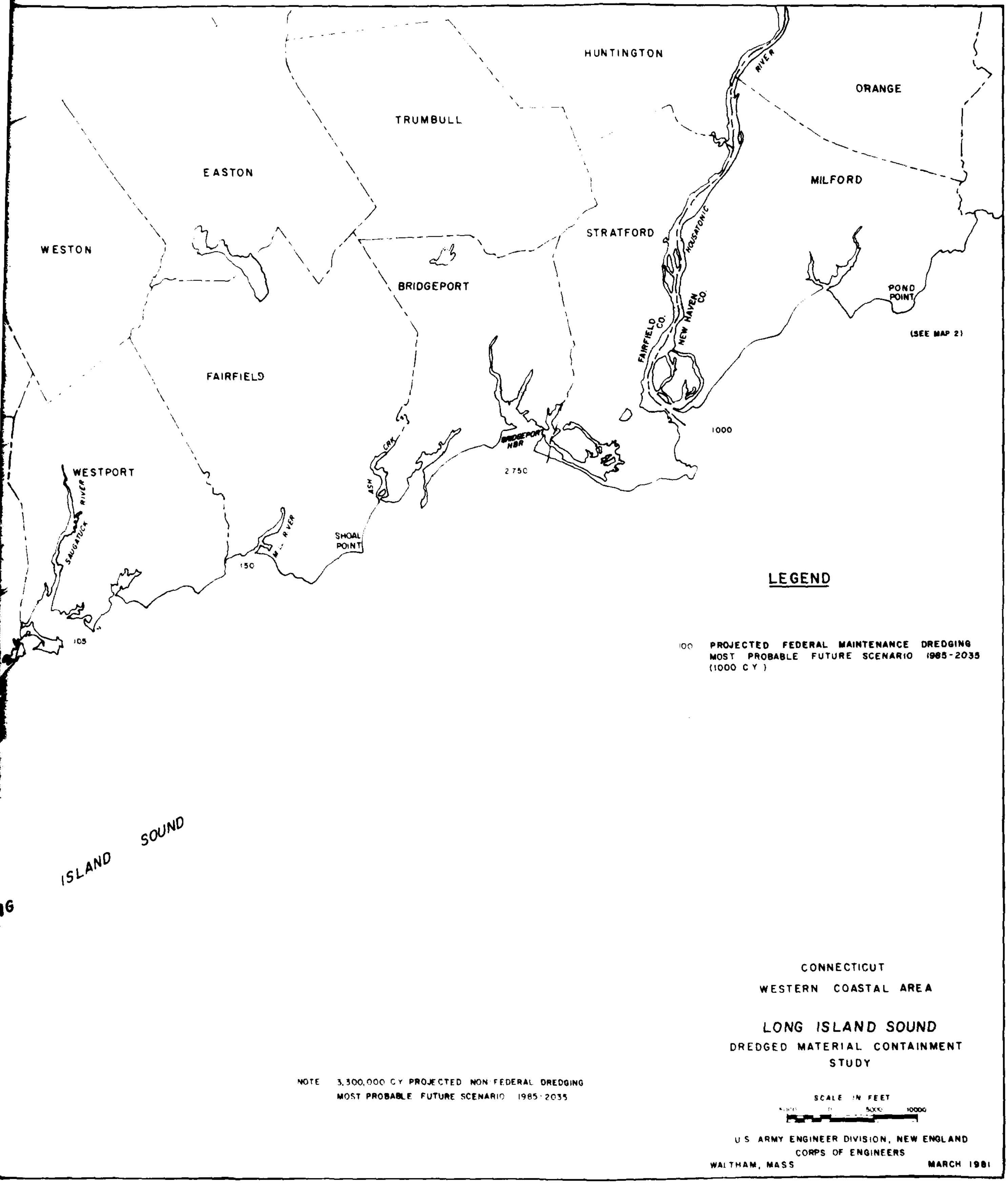
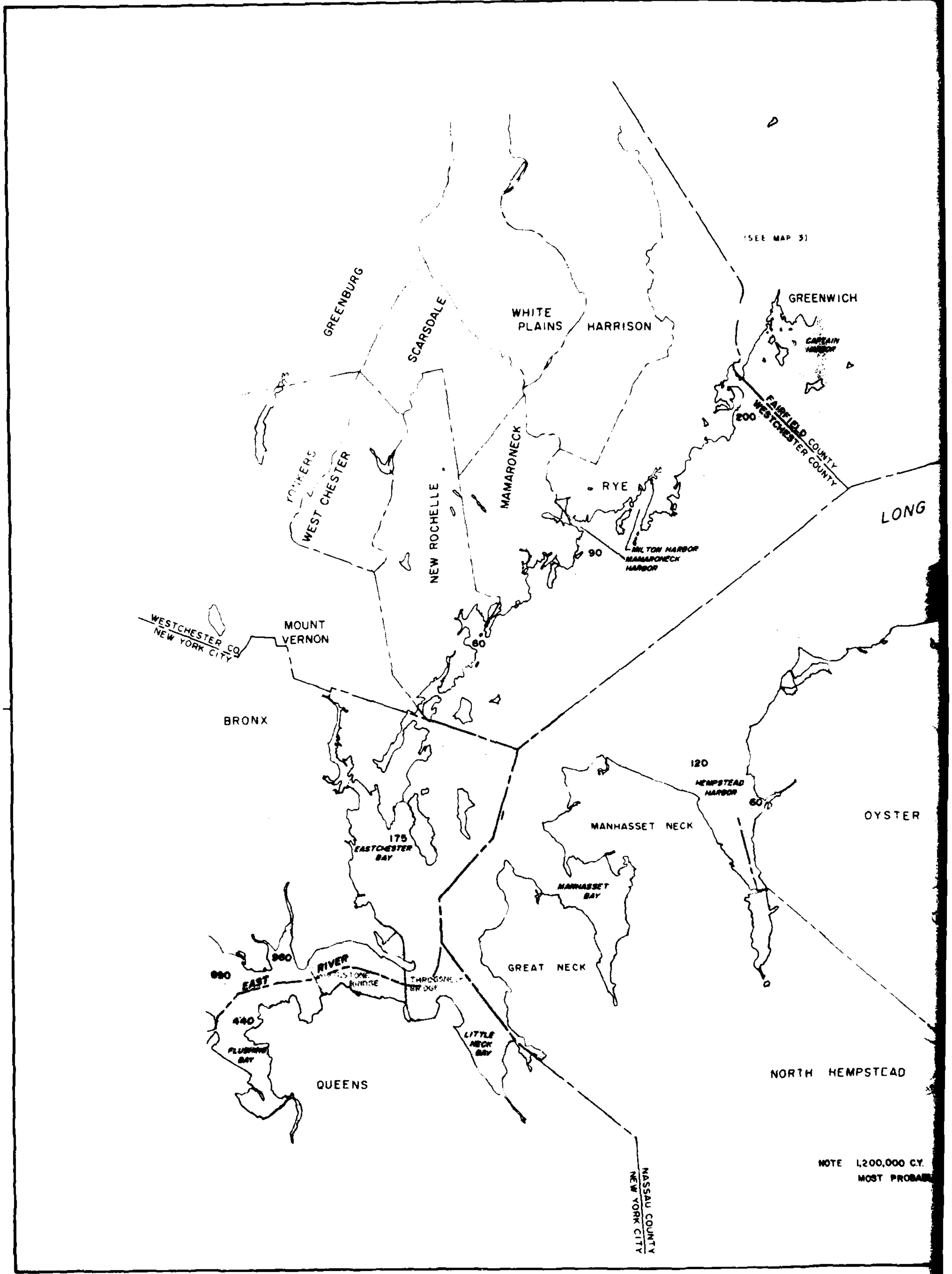

HUNTINGTON
ORANGE
TRUMBULL
EASTON
MILFORD
STRATFORD
WESTON
BRIDGEPORT
FAIRFIELD
WESTPORT
RIVER
HOUSATONIC
FAIRFIELD CO.
NEW HAVEN CO.
POND POINT
(SEE MAP 2)
1000
BRIDGEPORT HBR
2,750
ASH CRK
SAUGATUCK RIVER
SHOAL POINT
150
105
ISLAND SOUND
LEGEND
100 PROJECTED FEDERAL MAINTENANCE DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 C Y)
CONNECTICUT
WESTERN COASTAL AREA
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY
NOTE 3,300,000 C Y PROJECTED NON FEDERAL DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035
SCALE IN FEET
5000 10000
U S ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
MARCH 1981

Plate IV-3

2



(SEE MAP 3)
GREENWICH
CAPTAIN HARBOR
FAIRFIELD COUNTY
WESTCHESTER COUNTY
200
GREENBURG
SCARSDALE
WHITE PLAINS
HARRISON
MAMARONECK
RYE
LONG
WEST CHESTER
NEW ROCHELLE
90
MILTON HARBOR
MAMARONECK HARBOR
WESTCHESTER CO
NEW YORK CITY
MOUNT VERNON
60
BRONX
120
HEMPSTEAD HARBOR
60
OYSTER
MANHASSET NECK
175
EASTCHESTER BAY
MANHASSET BAY
GREAT NECK
960
EAST RIVER
WHITESTONE BRIDGE
THROGS NECK BRIDGE
440
FLUSHING BAY
LITTLE NECK BAY
QUEENS
NORTH HEMPSTEAD
NOTE 1,200,000 C.Y.
MOST
NASSAU COUNTY
NEW YORK CITY

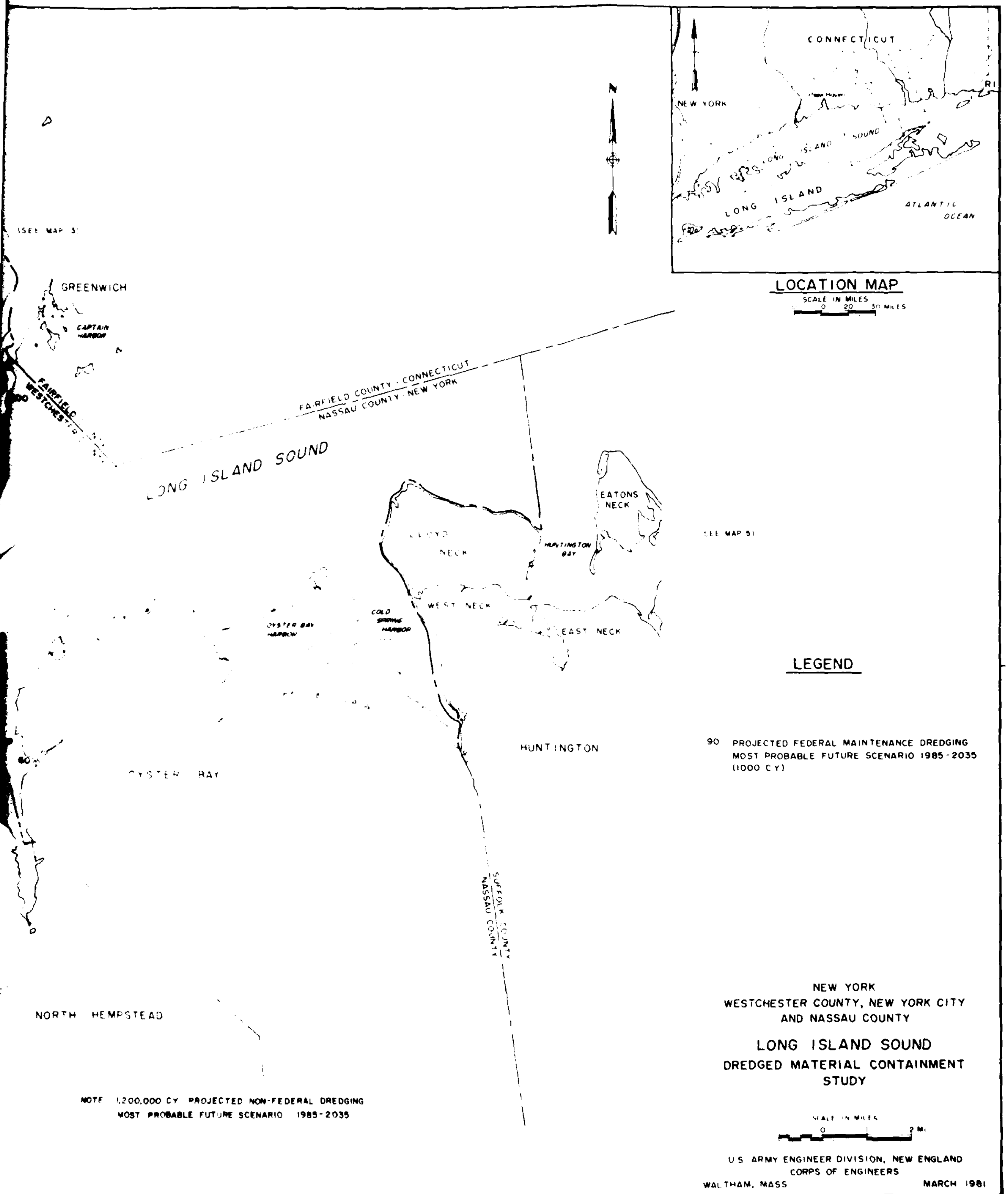
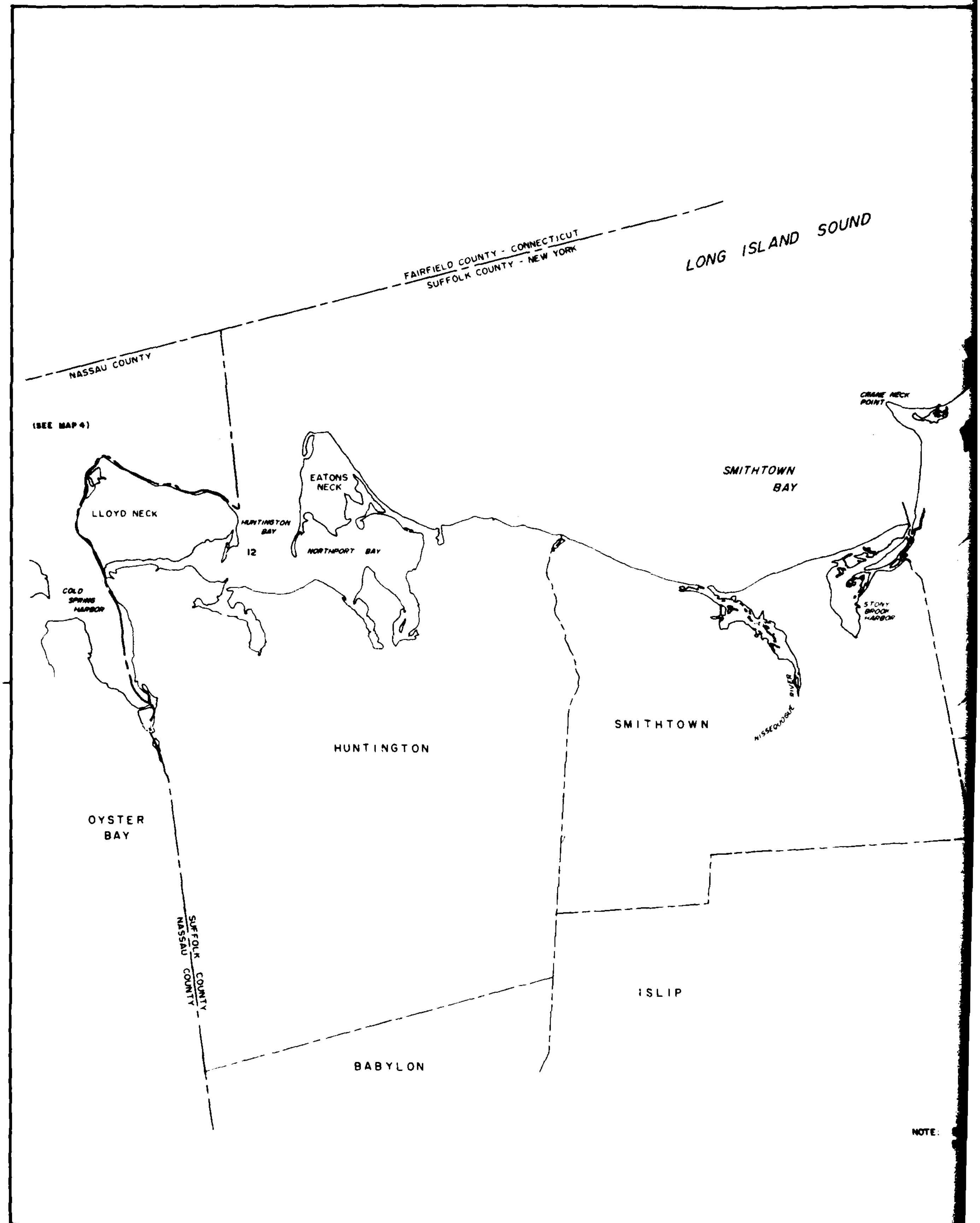

CONNECTICUT
NEW YORK
RI
LONG ISLAND SOUND
LONG ISLAND
ATLANTIC OCEAN
LOCATION MAP
SCALE IN MILES
0 20 30 MILES
N
(SEE MAP 3)
GREENWICH
CAPTAIN HARBOR
FAIRFIELD
WESTCHESTER
FAIRFIELD COUNTY · CONNECTICUT
NASSAU COUNTY · NEW YORK
LONG ISLAND SOUND
EATONS NECK
LLOYD NECK
HUNTINGTON BAY
SEE MAP 5
WEST NECK
EAST NECK
OYSTER BAY HARBOR
COLD SPRING HARBOR
HUNTINGTON
OYSTER BAY
SUFFOLK COUNTY
NASSAU COUNTY
NORTH HEMPSTEAD
LEGEND
90 PROJECTED FEDERAL MAINTENANCE DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 CY)
NOTE 1,200,000 CY PROJECTED NON-FEDERAL DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035
NEW YORK
WESTCHESTER COUNTY, NEW YORK CITY
AND NASSAU COUNTY
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
SCALE IN MILES
0 1 2 MI
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
MARCH 1981

Plate IV-4

2



LONG ISLAND SOUND
FAIRFIELD COUNTY - CONNECTICUT
SUFFOLK COUNTY - NEW YORK
NASSAU COUNTY
(SEE MAP 4)
CRANE NECK POINT
SMITHTOWN BAY
EATONS NECK
LLOYD NECK
HUNTINGTON BAY
12
NORTHPORT BAY
COLD SPRING HARBOR
STONY BROOK HARBOR
NISSEQUOGUE RIVER
SMITHTOWN
HUNTINGTON
OYSTER BAY
SUFFOLK COUNTY
NASSAU COUNTY
ISLIP
BABYLON
NOTE:

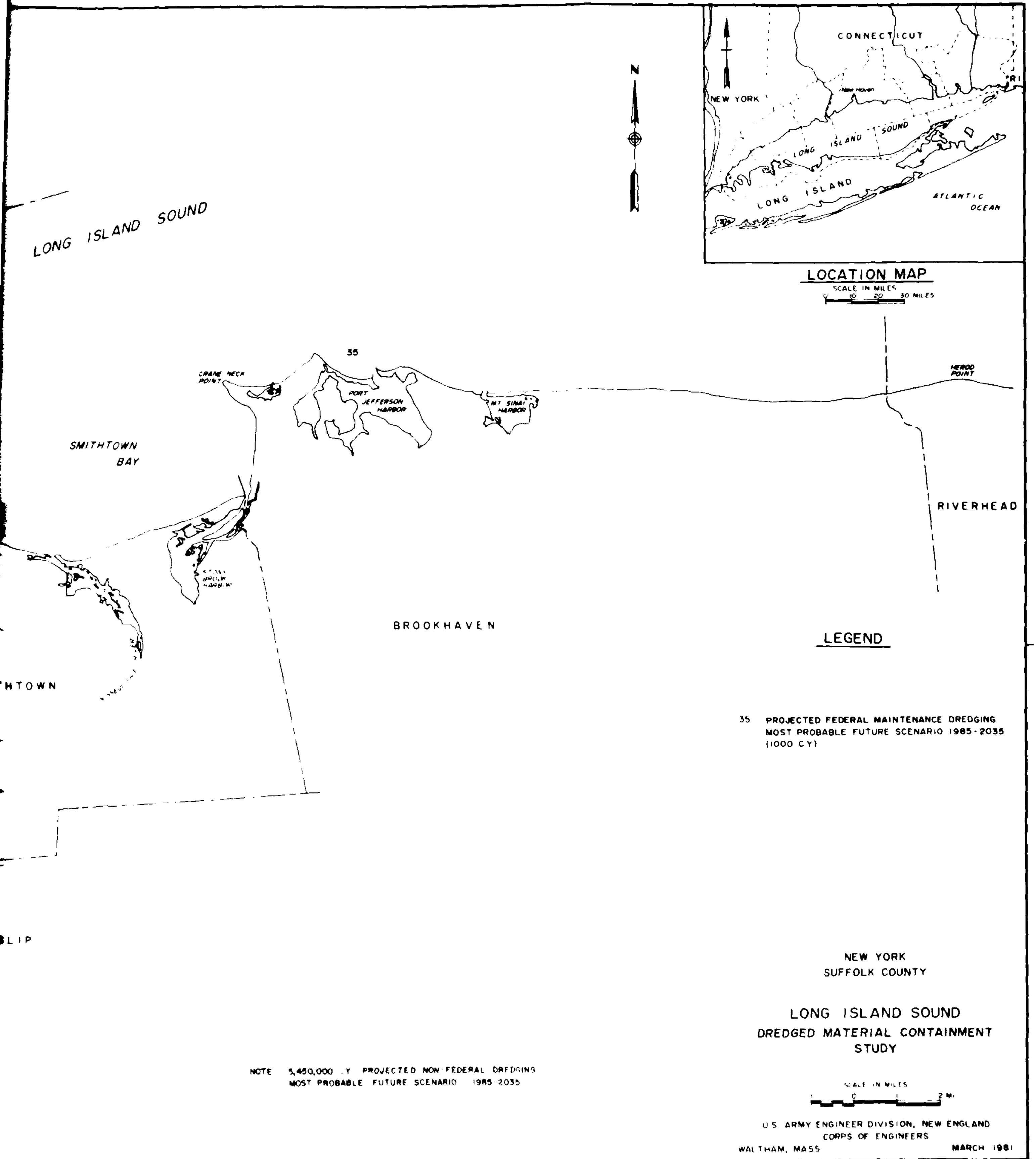

CONNECTICUT
NEW YORK
New Haven
RI
LONG ISLAND SOUND
LONG ISLAND
ATLANTIC OCEAN
LOCATION MAP
SCALE IN MILES
0 10 20 30 MILES
N
LONG ISLAND SOUND
35
CRANE NECK POINT
PORT JEFFERSON HARBOR
MT. SINAI HARBOR
HEROD POINT
SMITHTOWN BAY
RIVERHEAD
BROOKHAVEN
HTOWN
SLIP
LEGEND
35 PROJECTED FEDERAL MAINTENANCE DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035 (1000 CY)
NOTE 5,450,000 CY PROJECTED NON FEDERAL DREDGING MOST PROBABLE FUTURE SCENARIO 1985-2035
NEW YORK
SUFFOLK COUNTY
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY
SCALE IN MILES
0 2 MI
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
MARCH 1981

Plate IV-5

TABLE IV-4

PROJECTED NON-CORPS DREDGING BY PERMIT--1985-2035

Coastal Area	Minimum Growth Scenario	Most Probable Future Scenario	Maximum Growth Scenario
Connecticut:			
Western	2,992,000	3,740,000	4,488,000
Central	7,856,000	9,820,000	11,784,000
Eastern	18,260,000	22,825,000	27,390,000
	(3,696,000)[a]	(4,620,000)[a]	(5,544,000)[a]
New York:			
Westchester County	640,000	800,000	960,000
Nassau County	556,000	695,000	834,000
Suffolk County	3,328,000	4,035,000	4,842,000
New York City	1,128,000	1,410,000	1,692,000
Total	34,660,000	43,325,000	51,990,000

[a] Excluding New London Harbor Improvement by U.S. Navy.

TABLE IV-5

PROJECTED FEDERAL IMPROVEMENT DREDGING
MINIMUM GROWTH SCENARIO--1985-2035

Coastal Area	Project	Quantity Dredged (C.Y.)
Connecticut:		
Western	Black Rock Harbor	150,000
	Others (not yet proposed)	200,000
Total		350,000
Central	Clinton Harbor	230,000
	Patchogue River	30,000
	Others (not yet proposed)	200,000
Total		460,000
Eastern	Not yet proposed	200,000
New York:		
Westchester County	Not yet proposed	100,000
Nassau County	Not yet proposed	100,000
Suffolk County	Not yet proposed	100,000
New York City	Not yet proposed	200,000
Total		500,000
LIS Total		1,510,000

TABLE IV-6

PROJECTED FEDERAL IMPROVEMENT DREDGING
MOST PROBABLE FUTURE SCENARIO--1985-2035

Coastal Area	Project	Quantity Dredged (C.Y.)
Connecticut:		
Western	Bridgeport Harbor	2,500,000
	Black Rock Harbor	150,000
	Others Not Yet Proposed	300,000
Total		2,950,000
Central	New Haven Harbor	7,200,000
	Clinton Harbor	230,000
	Patchogue River	30,000
	Others Not Yet Proposed	300,000
Total		7,760,000
Eastern	New London Harbor	1,600,000
	Others Not Yet Proposed	300,000
Total		1,900,000
New York:		
Westchester County	Echo Bay	150,000
	New Rochelle Harbor	150,000
	Others not yet proposed	100,000
Nassau County	Not yet proposed	150,000
Suffolk County	Not yet proposed	150,000
New York City	Not yet proposed	300,000
Total		1,000,000
LIS Total		13,350,000

AD-A128 227 THE LONG ISLAND SOUND DREDGED MATERIAL CONTAINMENT FEASIBILITY STUDY(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 83

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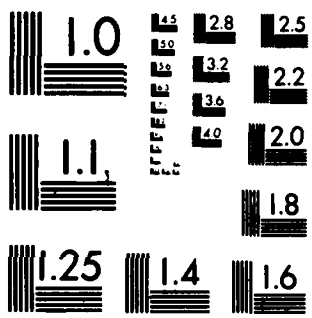


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE IV-7

PROJECTED FEDERAL IMPROVEMENT DREDGING
MAXIMUM GROWTH SCENARIO--1985-2035

Coastal Area	Project	Quantity Dredged (C.Y.)
Connecticut:		
Western	Bridgeport Harbor	2,500,000
	Black Rock Harbor	150,000
	Others Not Yet Proposed	500,000
		3,150,000
Central	New Haven Harbor	7,200,000
	Clinton Harbor	230,000
	Patchogue River	30,000
	Others Not Yet Proposed	500,000
Total		7,960,000
Eastern	New London Harbor	1,600,000
	Others Not Yet Proposed	500,000
Total		2,100,000
New York:		
Westchester County	Echo Bay	150,000
	New Rochelle Harbor	150,000
	Others not yet proposed	300,000
Nassau County	Not yet proposed	400,000
Suffolk County	Not yet proposed	400,000
New York City	Not yet proposed	500,000
Total		1,900,000
LIS Total		15,470,000

TABLE IV-8

SUMMARY OF PROJECTED DREDGED MATERIAL QUANTITIES (C.Y.) 1985-2035

Scenario	Coastal Area	Federal Maintenance Dredging	Non-Federal Dredging	Federal Improvement Dredging	Total
Connecticut:					
Minimum Growth	Western	4,290,000	2,992,000	350,000	7,632,000
	Central	9,520,000	7,856,000	460,000	17,836,000
	Eastern	940,000	3,696,000	200,000	4,836,000
	Total	14,750,000	14,544,000	1,010,000	30,304,000
Most Probable Future	Western	5,615,000	3,740,000	2,950,000	12,305,000
	Central	12,330,000	9,820,000	7,760,000	29,910,000
	Eastern	1,630,000	4,620,000	1,900,000	8,150,000
	Total	19,575,000	18,180,000	12,610,000	50,365,000
Maximum Growth	Western	7,255,000	4,488,000	3,150,000	14,893,000
	Central	14,135,000	11,784,000	7,960,000	33,879,000
	Eastern	2,360,000	5,544,000	2,100,000	10,004,000
	Total	23,750,000	21,816,000	13,210,000	58,776,000
New York:					
Minimum Growth	Westchester County	310,000	640,000	100,000	1,050,000
	Nassau County	120,000	556,000	100,000	776,000
	Suffolk County	187,000	3,228,000	100,000	3,515,000
	New York City	1,930,000	1,128,000	200,000	3,358,000
	Total	2,547,000	5,552,000	500,000	8,599,000
Most Probable Future	Westchester County	410,000	800,000	400,000	1,610,000
	Nassau County	180,000	695,000	150,000	1,025,000
	Suffolk County	327,000	4,035,000	150,000	4,512,000
	New York City	2,465,000	1,410,000	300,000	4,175,000
	Total	3,382,000	6,940,000	1,000,000	11,322,000
Maximum Growth	Westchester County	530,000	960,000	600,000	2,090,000
	Nassau County	220,000	834,000	400,000	1,454,000
	Suffolk County	409,000	4,842,000	400,000	5,651,000
	New York City	2,935,000	1,692,000	500,000	5,127,000
	Total	4,094,000	8,328,000	1,900,000	14,322,000
Total					
Minimum Growth		17,297,000	20,096,000	1,510,000	38,903,000
Most Probable Future		22,957,000	25,120,000	13,610,000	61,687,000
Maximum Growth		27,844,000	30,144,000	15,110,000	73,098,000

problem becomes more emminent. Although it is improbable that no future dredging may be allowed due to the lack of disposal sites, that extreme possibility must be considered because of the severe economic impact that would be felt throughout the region. A more realistic, future, possibility would be that in the absence of any new disposal sites, a greatly reduced dredging program at infrequent intervals and great cost would result. The impacts of a no action alternative or a severely limited future dredging alternative are similar in nature.

The major effects of no action/limited action would be borne by receivers of petroleum products because they currently utilize the channels most extensively. Power generators, dependent on water transport for delivery of residual fuel oil to produce electricity, would be adversely effected to a very significant degree if channel depths became even more restrictive in the future. Presently dependent on foreign fuel as their major source of supply, the most ecohomical means of transporting the residual over long distances is via the largest tanker that can be accommodated because the cost per unit shipped decreases as tanker size increases. Also, substantial economic costs due to tidal delays are encountered when vessels are required to wait for high water conditions before approaching a terminal to unload their cargo. All of these additional costs are ultimately passed on to the consumer in the form of higher electric rates, further impacting on all areas of the economy by providing a disincentive for commercial and industrial growth.

If widespread conversion to coal as a source of fuel for electrical generation occurs in the future as suggested by the U.S. Department of Energy, the impacts of inadequate channel conditions would be similar. The economy of scale achievable through the use of maximum sized vessels would be precluded as a possibility, and additional costs would be passed to the consumer.

Similar negative effects would be borne by receivers of other petroleum products, particularly distillate fuel for home heating and gasoline for automotive use. Rapidly escalating costs have placed a discernible financial burden on home and car owners and reduced the portion of their expendable income that would normally be spent on durable goods, leisure activities, or other preferences. If inadequate future channel depths resulted in increased transportation costs reflected by increased prices of home heating oil and gasoline, total spending would remain high, ability to save would decrease, and an even larger percentage of expendable income would be diverted from nonfuel uses.

Although the economy of the region surrounding Long Island Sound has passed through a transition period from a manufacturing base that produced bulk commodities suited for a water transport to a more service oriented base, with manufacturing activity inclined toward the electronic and chemical industries, some bulk commodity movement is still dependent on adequate port conditions. The importance of sand, gravel, and crushed stone shipments over water will increase as local sources diminish and

alternative transport modes increase in cost. If the iron and steel scrap export business is to survive along Long Island Sound, channel depths will have to be maintained. The principal markets have shifted to foreign ports and use of larger vessels has therefore become desirable. Although there are currently no definite plans for development of a container port in the region, the no action/limited action alternative would preclude that possibility as a means of future economic growth.

The significance of recreational boating to the regional economy should not be overlooked in consideration of the impacts of limited future dredging. Powerboating and sailing have grown rapidly in popularity over the most recent decade, and evidenced by the waiting lists for mooring facilities common at yacht clubs and marinas along the Sound. The larger the boat, the greater the investment necessary and the deeper the draft required, particularly in the case of sailing vessels. Thus, as channel conditions deteriorated and future dredging operations diminished, boat owners would become less and less likely to realize a suitable return on their investment. Channel passage for larger boats would be restricted to high tide conditions, and more frequent groundings would cause additional vessel damages. As the region became less attractive as a site for boating activity, economic losses would be sustained by boat owners, marina owners, boat manufacturers, and over the long run, boat repair yards. Several ancilliary businesses, such as sporting goods stores, dockside gasoline dealers, bait and tackle shops, and fast food services would also be negatively impacted by a decrease in recreational boating.

The no action/limited action alternative would also negatively impact commercial fishing at Long Island Sound ports. With the future of the industry looking optimistic due to increased fish stocks resulting from successful implementation of the 200 mile limit on territorial waters, the prospect for substantial gains in the contribution of commercial fishing to the regional economy is not unrealistic. However, the trend in the industry is toward the use of large, more diversified, vessels; shallow conditions at any given port may preclude the possibility of expansion.

Chapter V

PLAN FORMULATION

TABLES

PLATES

FIGURES

PLANNING OBJECTIVES

1. Provide an alternative solution to the disposal of dredged material from maintenance of existing Federal channels and anchorages in the LIS area.

2. Provide an alternative solution to the disposal of dredged material from new channel and anchorage improvements currently under consideration by the Corps of Engineers as Federal Projects.

3. Provide an alternative solution for the disposal of dredged material from dredging by other Federal agencies, and from non-Federal and private dredging.

4. Provide dredged material containment facilities with the combined volume equal to or greater than the total volume of objectionable material to be dredged from Long Island Soud within the next 50 years.

5. Maximize the size of an individual containment facility to lessen the overall cumulative impacts of dredged material disposal throughout Long Island Sound.

6. Minimize the adverse impacts that could be created by construction of a dredged material containment facility on bottom lands, wetlands, coastal zones, and marine life in the LIS area.

7. Maximize the long term and short term use potential of the dredged material containment facility.

8. Maximize the use of the contained dredged material as a natural resource through reuse management techniques.

9. Minimize the economic costs to potential users of the dredged material containment facility.

10. Develop a methodology and rationale for Federal cost sharing of containment of dredged materials in Long Island Sound that may be applicable throughout New England.

11. Provide environmental quality enhancements to the Long Island Sound area utilizing dredged material containment facilities as bird sanctuaries or other wildlife habitat.

12. Maximize the amount of wetland creation from suitable dredged material.

PLANNING CONSTRAINTS

- Any structure built on a proposed containment facility must be built in accordance with all applicable flood plain zoning requirements.

- Proposed land use of the containment site(s) must be compatible with adjacent area land use and consistent with local zoning regulations.

- The containment facilities must be in compliance with the coastal zone management plans for the States of Connecticut and New York.

- Proposed site plan(s) should complement regional long-range management plans.

- Proposed land use will be dependent upon dredged material structural properties and containment site subsurface conditions.

- Unless a cell-type design or very small containment facilities are planned, the land created will be unavailable for uses other than disposal for at least ten years.

- Disposal site(s) must be situated close enough to potential dredging projects to avoid prohibitive transportation costs.

- Project sponsor needed to finance and develop the containment site if Federal funds are not available.

- If a containment facility is to be recommended in or near an ecologically sensitive area, detailed investigations or mitigation measures will be necessary.

- The research findings of the Dredged Material Research Program (DMRP) should be incorporated into the overall study effort.

SITE SELECTION PROCESS

Introduction

The search for suitable dredged material containment facility sites for the Long Island Sound area has not been an easy task. This plan formulation appendix is based upon several different studies and methods of analysis. Alternative methods of disposal have not been considered as it is not the intent of this containment study to evaluate them. Nor is it the intent of this study to present an array of alternative sites or a management plan involving several combinations of methods to handle the disposal of all the dredged material for Long Island Sound for the next 50 years. The purpose of this study is to determine where DMCF's are feasible for Long Island Sound. This progress report details the status of the overall study effort at the present time. The sites that have been considered in the final screening of this report may not be a complete list. As more people are made aware of our study findings, some additional sites may be suitable and some of the considered sites may be dropped due to local opposition.

One factor which has contributed to the difficulty in initiating the site selection process is that there are no existing, developed containment facilities in the nearby area surrounding Long Island Sound. (The closest "designed" containment facilities are on the Delaware River in Pennsylvania and they have not been fully designed according to the most recent DMRP findings). This is a factor which has led many groups to be hesitant to recommend or support a site for a marsh creation project, island facility or shoreline extension scheme. There is nothing to easily compare it to either aesthetically or environmentally. While this office has presented slide shows encompassing what DMCF's look like on numerous occassions the fact remains that containment facilities have not been built in this region.

The concept for dredged material containment facilites for Long Island Sound is not an entirely new subject. In June 1974, McAleer prepared "Artificial Islands and Platforms in Long Island Sound" for the New England River Basins Commission. He mentioned about 60 possible sites in his report, mainly shoal areas within 1 1/2 miles from shore. No recommendations were made.

Reconnaissance Report Screening

For the purposes of this study initial work on plan formulation began during preparation of the Reconnaissance Report (January 1979). At that time, planning was centered on finding A) a single facility to receive all dredged material projected for the entire study area (at that time limited to Connecticut) from 1985 to 2035 and B) three facilities to receive all dredged material projected for each of the three Connecticut coastal areas from 1985 to 2035. One facility would be located in each coastal area.

Three types of projects and siting zones were assumed: (1) Shoreline extension in water depths of up to 6 feet mean low water (mlw); (2) nearshore islands in water depths of up to 18 feet mlw; and (3) offshore islands in water depths of up to 54 feet mlw. In the Reconnaissance Report it was determined that there would be about 59 million cubic yards (MCY) of dredged material to be disposed of in Long Island Sound during the 50 year projection period. It was assumed, for estimating purposes, that all of it would be required to be contained.

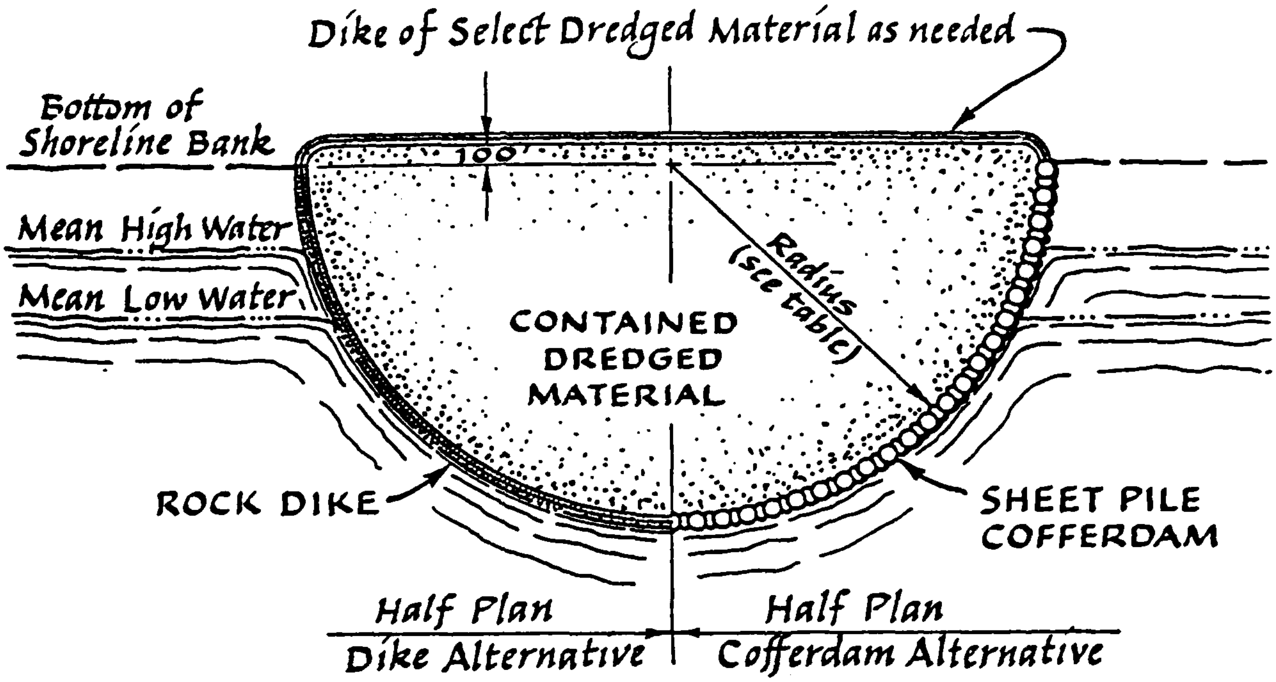
The Reconnaissance report had specific design requirements for the containment facility analysis. The shoreline extension concept assumes that the facility could be built in shallow water with an average depth of -3 feet mlw and a required final fill elevation of +20 feet mlw, resulting in a final depth of fill of 23 feet. The nearshore island would be built in an area where the average water depth would be 12 feet and the final fill elevation +20 feet mlw resulting in a depth of 32 feet. The offshore island would be built in 36 feet of water with an average fill elevation of 56 feet.

These design requirements have been used in determining sizing for the design types under consideration. A circular configuration was used in this portion of the study for analysis because it represents the most economical shape (least amount of retaining structure per unit volume of dredged material contained). Capacities which were investigated were 12 MCY, the 50-year volume for both western and eastern coastal areas; 20 MCY, about half of the maximum design volume; 37 MCY, the 50-year total volume from the central coastal area; and 59 MCY, the maximum design volume. Figures V-1 and V-2 show the results of this effort. Figure V-3 shows cross sections for a rock dike and steel sheet pile dike options with dimensions indicated for each of the three required alternative design locations. (The figure V-3 uses the word liner and filter cloth interchangeably. The correct terminology should be filter cloth). For an offshore island, the approximate width of the base of rock dike would be 176 feet.

The basic assumptions used in the Reconnaissance Report for selecting the various structural alternatives were:

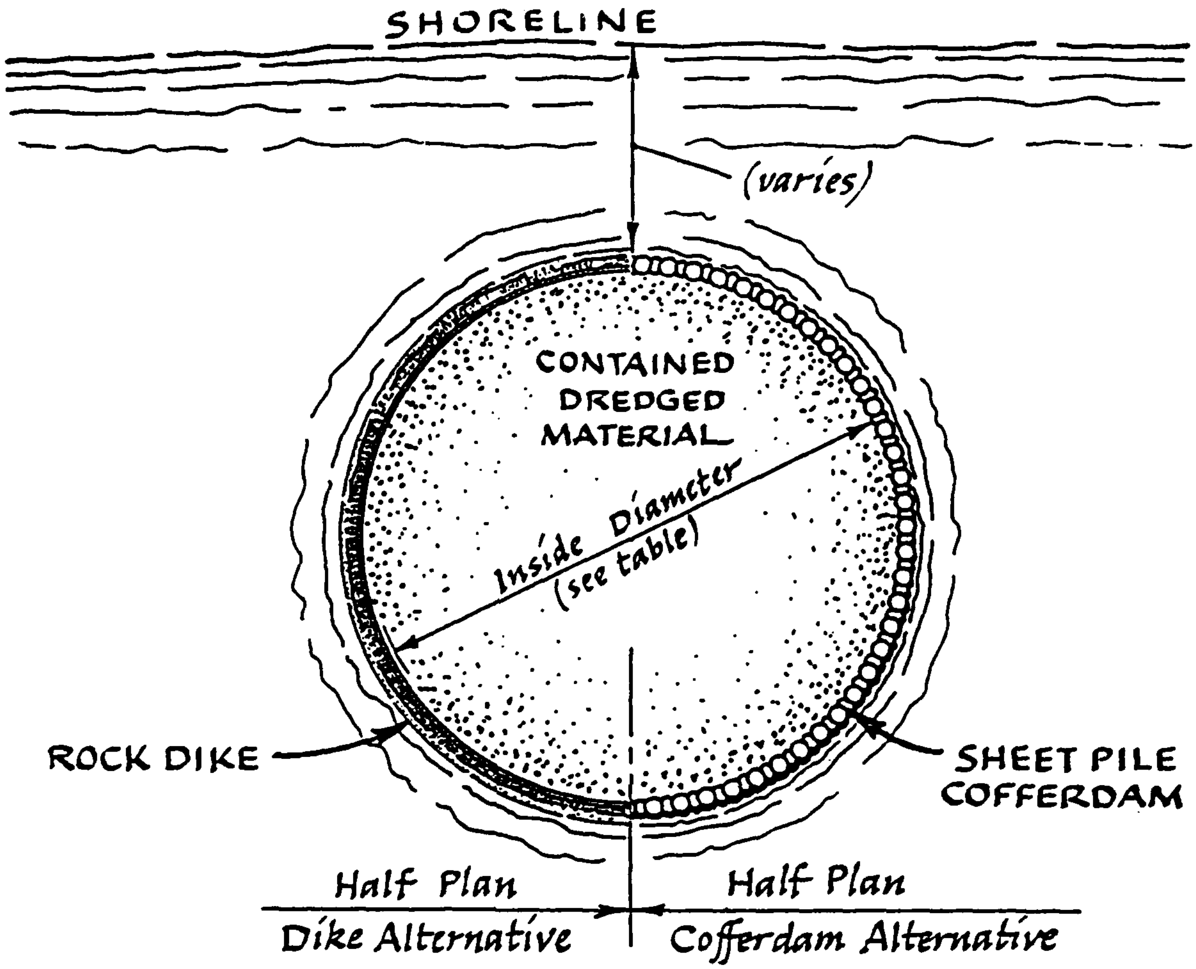
(1) The dredged material will be of no structural value
(2) The dredged material will undergo very little consolidation within the containment facility
(3) The dredged material will remain in the wet condition within the facility (this is the worst design condition)
(4) The bottom of Long Island Sound is predominantly soft silt and loose fine sand overlying progressively stiffer clays
(5) Bedrock stratum will not be encountered

These unfavorable conditions immediately eliminated many types of structural alternatives including; sheet piles with tie-backs and any other system dependent upon the fill material for support; cantilevered



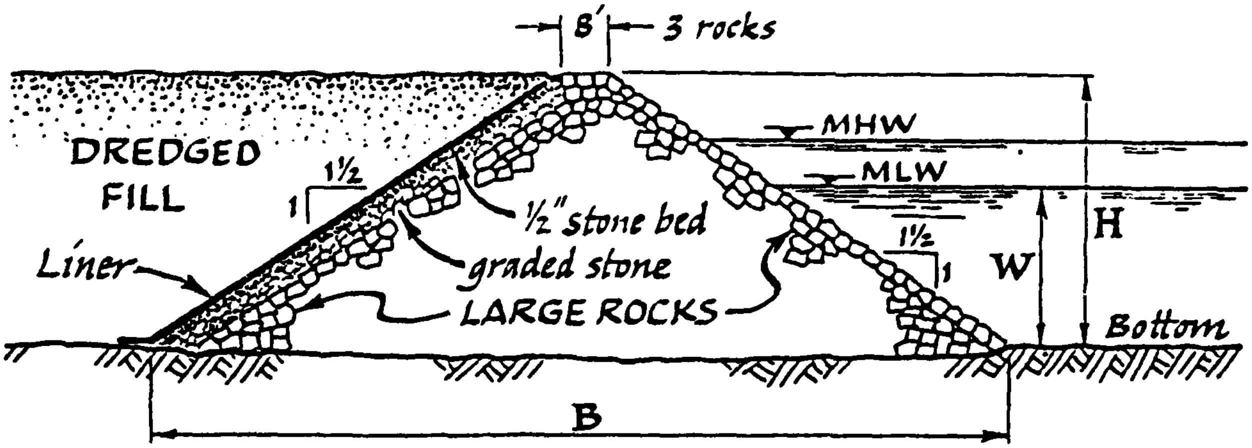
CAPACITY (million cubic yards)	RADIUS (feet)
12	3179
30	5045
37	5606
59	7088

Figure V-1 Rock dike and sheet pile cofferdam shoreline configuration.

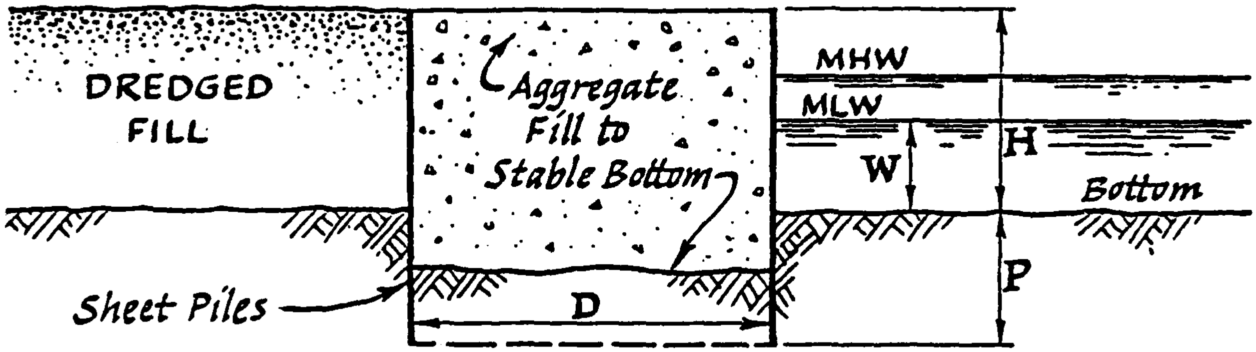


CAPACITY (million cubic yards)	INSIDE DIAMETER (feet)	
	Near shore	Off shore
12	3590	2714
30	5676	4292
37	6304	4766
59	7960	6020

Figure V-2 Rock dike and sheet pile cofferdam nearshore and offshore configurations.



Cross Section of Rock Dike



Cross Section of Sheet Pile Cofferdam

Dimension	Shoreline	Nearshore	Offshore
H	23′	32′	56′
W	3′	12′	32′
B	77′	104′	176′
D	54′	78′	138′
P	15′	32′	40′

Figure V-3 Rock dike and sheet pile cofferdam cross sections.

walls of any type due to the poor structural support of the subsoil and the high soil bearings pressure that would be generated; dikes using dredged material as core material; low dikes with wall extensions due to the high soil bearing pressures that would be generated.

The steel sheet piling used in the cofferdam alternative would have to conform to applicable standards for use in the marine environment. The exterior faces of the sheets would be coated from the mud line up to the top with a coal tar epoxy. This system would be expected to last 25 to 30 years.

Based on the Reconnaissance Report, the dike would be built of large rocks which would be bottom-dumped from a barge for the offshore and nearshore application. The side slopes used in this report were assumed to be 1.5 horizontal to 1 vertical. The inside face of the dike would require a filter cloth which would retain the dredged material solids but allow the carrier water to pass through the dike. The inside face of the dike will need a layer of filter material down to about 1/2 inch stones. This would serve to protect the liner from puncture.

In both design considerations used in the Reconnaissance Report the soft bottom silt is assumed to be removed before construction because this would result in some significant settlement during the life of the structure.

A cost comparison of the two different design considerations for the three alternatives under consideration are show on Figure V-4. It is apparent that the rock-fill dike with a liner is the least cost alternative for all design considerations. In addition to being the cheapest, it offers the advantage of an indefinite life, favorable appearance, ease of construction, minimal maintenance and a rough sloping surface that provides attractive habitat for marine life.

The site selection process undertaken for the Reconnaissance Report began with a review of the sites that were mentioned in the McAleer report. Biological resources data for the Sound were then evaluated. Areas of high biological value were then eliminated from further consideration. Another important siting aspect used in this reconnaissance report was the various wind, tide current and wave energy regimes. The significant biological data and the wave/current energy regime are shown on Figures V-5 and V-6 respectively.

The results of the siting analysis was preliminary. It is to be reemphasized that the reconnaissance screening was geared to large-volume, long-life facilities. Small volume localized sites were not considered. Three shoreline extension projects were identified;

1. Bridgeport - between west breakwater and Tongue Point in Bridgeport Harbor.
2. New Haven - tidal flat area near Long Wharf and adjacent

to Connecticut Turnpike on west side of New Haven Harbor.
3. New Haven - tidal flat area adjacent to East Shore Park on east side of New Haven Harbor.

The report notes that upon closer examination all these sites were determined to be in proximity to shellfish habitats considered critical by the State of Connecticut. The nearby seeding grounds for oysters would eliminate them from further consideration. It concludes that the shoreline extension concept for containment of dredged material is not very promising for large-volume, long-term disposal. It further states that small volume isolated opportunities were not examined in this study but that the created land would not be useable without costly site engineering.

The criteria developed to initially identify nearshore areas as potential containment sites reflect a siting analysis based on finding nearshore areas which should be excluded. The preliminary nearshore siting review was designed to:

- Avoid environmentally sensitive areas such as shellfish beds, lobster and conch areas, finfish concentration zones and anadromous species spawning and migration areas.

- Avoid U.S. Navy operating areas.

- Avoid commercial and recreational boating navigation zones, particularly in limited open water zones.

- Avoid areas of high wave energy, principally near the eastern end of Long Island Sound.

- Avoid submerged historic wrecks, archeological sites, and heritage areas.

The Reconnaissance Report considered all nearshore and offshore sites suggested by McAleer. The nearshore sites were reviewed using the above guidance and the general social, aesthetic, and ecological criteria. All of the sites were judged essentially unfeasible as locations for a major disposal facility. The offshore sites promise the most potential for building a large volume, long-term dredged material containment facility. No specific locations were recommended other than general areas to consider. However, these areas should be in water deeper than 60 feet unless in areas formerly used for disposal of dredged material. Approximate site locations are shown on Plate V-1.

In summation, the Reconnaissance Report examined shoreline extension projects, nearshore, and offshore island creation projects. None of the sites considered, which were all in Connecticut in the screening effort, was smaller in volume than 12 MCY and the sizes evaluated varied up to 59 MCY which actually would have been equal to large regional sites. No site was suitable for consideration using the criteria established for

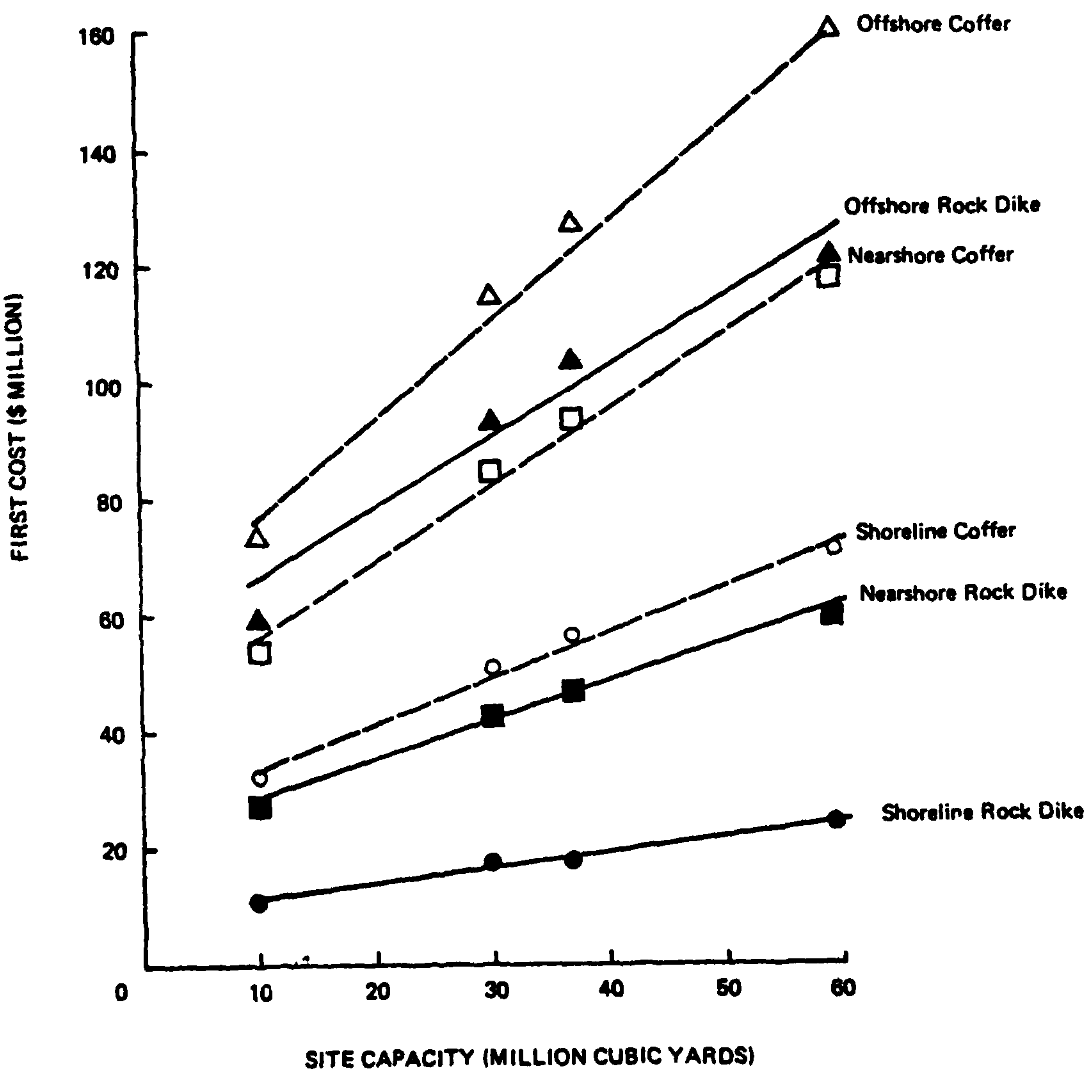
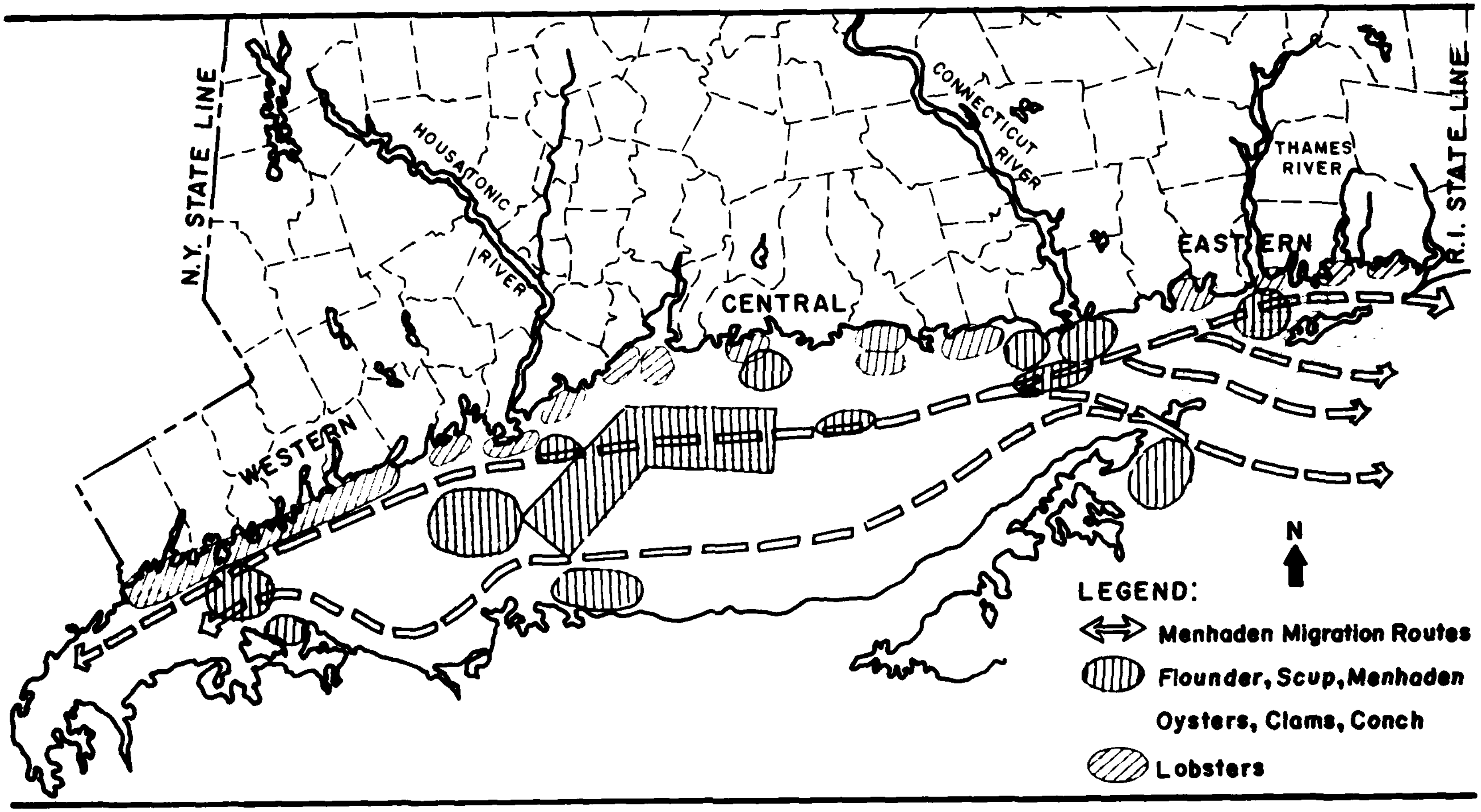


Figure V-4 Total first cost estimates of rock dike and sheet pile coffer dam.



FINFISH, SHELLFISH and LOBSTER fisheries in Long Island Sound.

Figure V-5

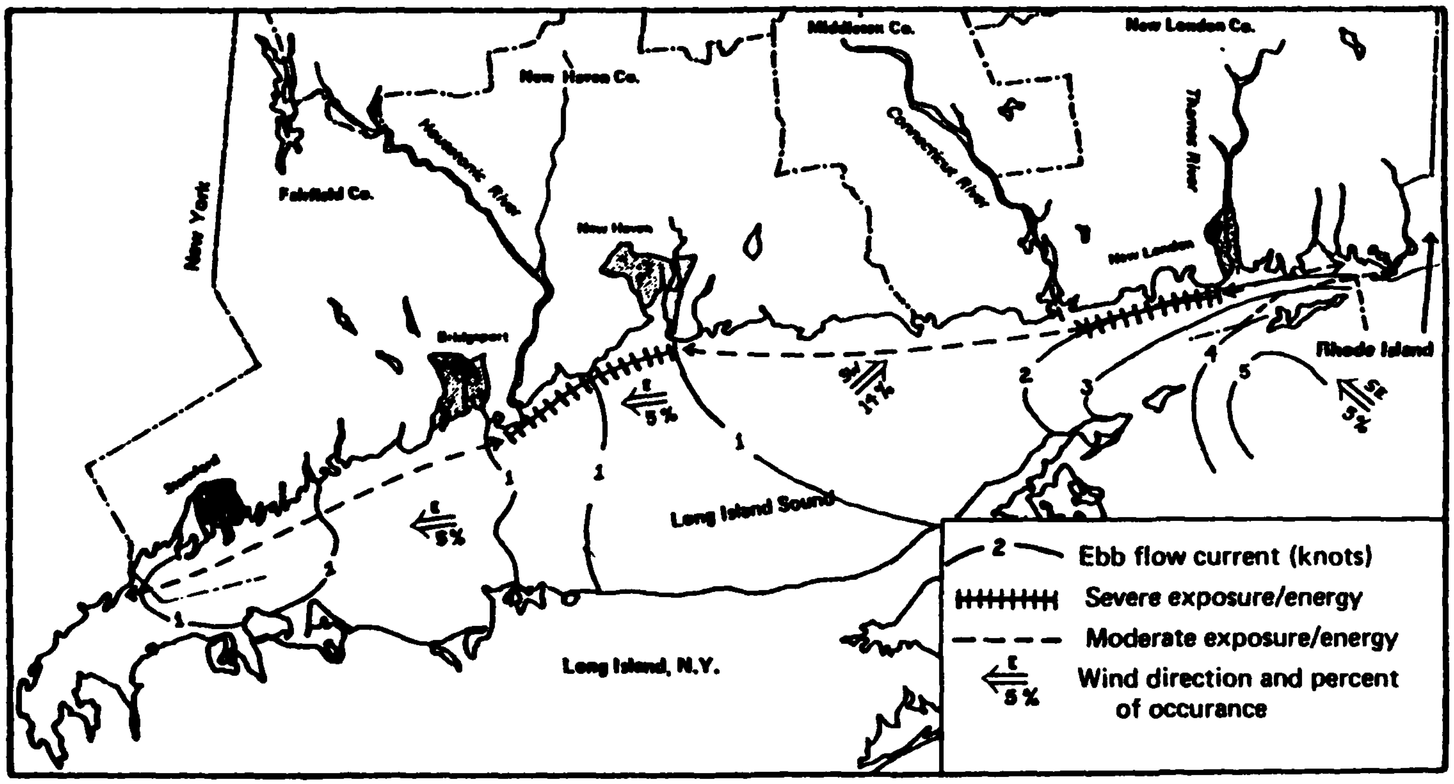
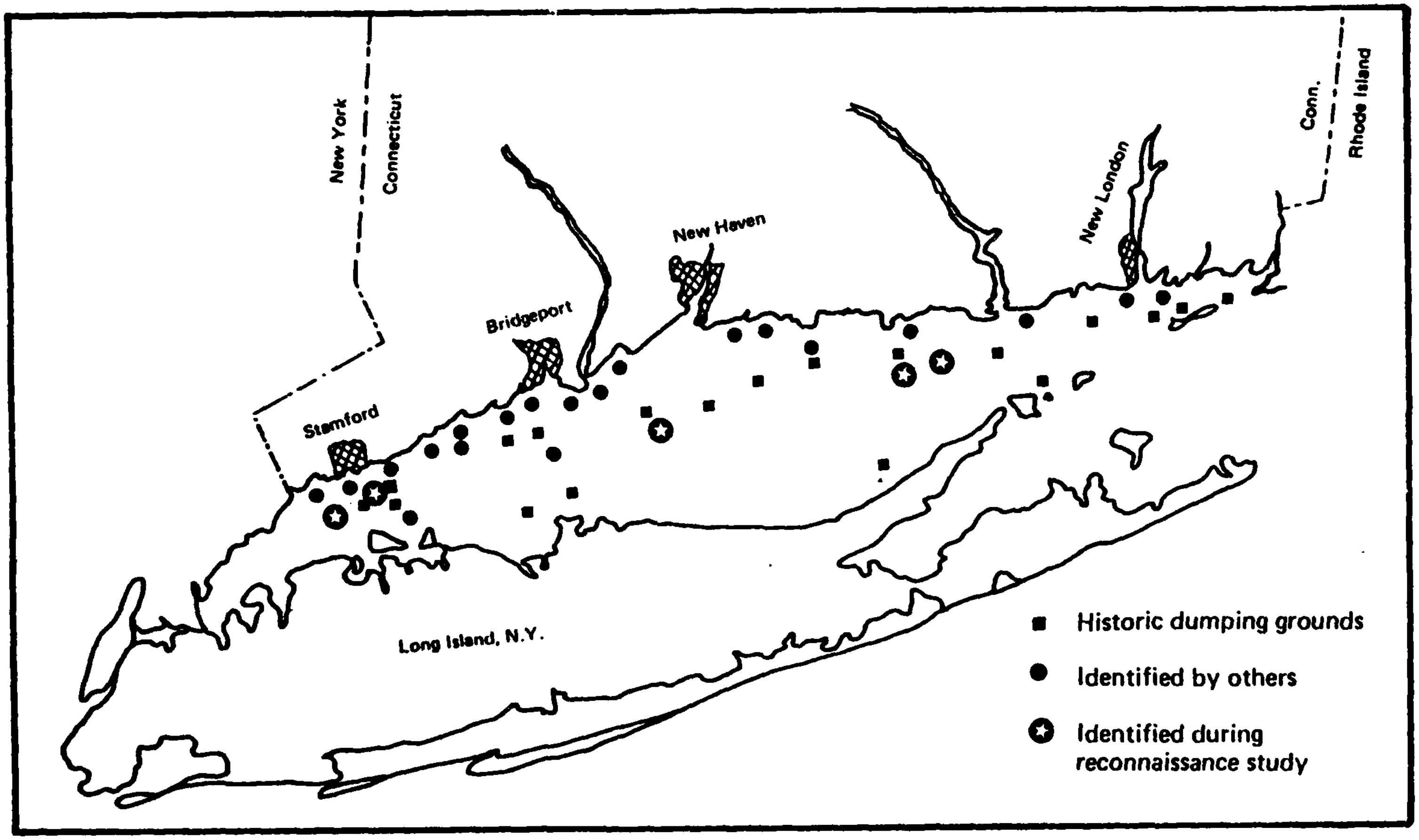


Figure V-6 Wave/current energy regimes in Long Island Sound.



Potential nearshore/offshore containment facility locations.

Plate V-1

evaluation. The report showed that large volume islands or large volume shoreline extension projects are not feasible in the Connecticut portion of Long Island Sound due to the tremendous environmental degradation which would be evident if a facility were constructed at the sites considered. These sites apparently represented the best available large scale sites.

Interim Report

The plan formulation presented in the Interim Report (July 1980) presented a preliminary siting analysis for shoreline extension containment opportunities for all of Long Island Sound. The analysis was conducted only for lands adjacent to publicly - owned shoreline. However, it considered small volume shoreline extensions (200,000 cubic yards and up) as opposed to the configurations analyzed in the Reconnaissance Report.

A four-step, preliminary siting method was developed for potential sites for detailed review and evaluation. While each step is performed sequentially, all were repeated several times before the preliminary siting was completed. The four steps are as follows:

(1) Identify and rank primary screening criteria for selecting alternative sites.
(2) Apply the criteria to Long Island Sound to obtain specific site alternatives.
(3) Preliminarily rank the alternative sites in relative order of desirability.
(4) Investigate the use of sites individually or in combinations to determine the potential of using more than one site.

The purpose of steps 1 and 2 was to eliminate from further consideration coastal areas of Long Island Sound not feasible for containment facility siting. This was performed on public lands only. Steps 1 and 2 served to greatly reduce the number of sites needing detailed investigation. Step 3 applied additional, more specific, criteria to areas surviving the first two steps. Step 4 formulates preliminary design of projects considering site specific issues, construction feasibility, operation, and other site specific factors. Each step is explained fully in the following paragarphs.

Step 1 - Identify and Rank Primary Screening Criteria for Selecting Alternative Sites. Primary screening criteria pertaining to the selection of alternative containment sites were identified and are discussed below in terms of their positive and/or negative aspects.

(1) Bathymetry/available containment volume - Bathymetry has several important effects on containment siting feasibility. The Reconnaissance Report showed that costs of a retaining dike increase nonlinearly with increasing depth. Also, larger dikes exert greater

foundation forces inducing various rates of settlement throughout the facility depending upon the soil bearing capacity. Dewatering and densifying procedures become more difficult as the amount of available moisture increases. This means that it is far easier to dewater/densify dredged material that is on a facility built in 10 feet of water rather than on 50 feet of water. For purposes of the Interim Report, -20 feet mean low water was arbitrarily chosen as the maximum depth to which a facility would be built.

(2) Shoreline Ownership and Existing Disposal Sites - For the purposes of this Interim Report private and semi-private shorelines (except for areas previously used for dredged material disposal) were not considered , only Federal, State and locally owned shorefront sites and existing historical shoreline disposal sites were considered.

Areas that have already been disturbed by previous dredged material disposal may or may not exhibit attributes favorable for containment siting. These areas may include beaches nourished with dredged materials, bulkheads along industrial or commercial waterfronts, previously low-lying (wetland) areas filled in for urban expansion or existing diked containment (upland) sites. Areas where beach nourishment has occurred were not included as being feasible due to their non-compatability between a beach and a containment site.

(3) Significant Ecological Areas - The potential ecological impacts due to construction and operation of a facility primarily stem from (1) short-term disturbance of the existing ecosystem due to construction and (2) long-term effects of dewatering effluent and leachate from operation of the facility. In order to minimize potential environmental conflicts, areas identified through available data which are known to exhibit significant concentrations of shellfish beds, lobster beds, crab habitats, waterfowl feeding/nesting, and finfish spawning/migration were eliminated from further consideration.

(4) Wetlands - Wetlands are a significant ecological resource and laws exist which prohibit their degradation or destruction. Any facility which infringes on a wetland is not a compatible use. However, as marsh creation/expansion is viable under certain conditions, these areas might offer potential siting advantages rather than disadvantages.

(5) Major Public Beaches - A large amount of the publicly owned lands surrounding Long Island Sound are public beaches. In general, an existing public (or private) beach would be highly undesirable for shoreline extension projects due to (1) public and political opposition (2) potential impacts on public health and welfare and (3) incompatability with the need for public recreation facilities, especially in highly urbanized areas.

(6) Wave Energy - Wave energy effects are of concern in the engineering and design aspects of the facility siting process. Areas of very high energy could require massive rock protection, which increases

the cross sectional requirements of the retaining dike. This greatly increases the construction cost. Most shoreline sites located in the high energy zones have been eliminated.

(7) Land Use Compatibility/Reuse Potential - A reusable containment facility for purposes of the interim report was defined as (1) one at which dredged material is continuously or periodically removed for other uses or (2) one which when filled to capacity can be used as an industrial, commercial, residential, recreational or other land use compatible with the intent of the project.

Step 2 - Applying the Criteria to Long Island Sound to Obtain Specific Site Alternatives. The purpose of the second step was to systematically eliminate from further consideration potential containment sites clearly not feasible based on the criteria outlined in Step 1. Working maps of Long Island Sound were first prepared which summarized the available information on the various screening considerations. Each was plotted on a separate overlay and each overlay assigned a relative significance factor. As each criteria is applied the number of sites surviving is reduced.

The ranking of the above seven primary screening criteria is an iterative process where the different considerations are applied to each site investigated. As potential candidate sites are evaluated and survive the screening criteria of Steps 1 and 2, a new iteration considering different sets of key criteria from step 1 is applied. Eventually, a managable number of sites were selected to undergo the steps 3 and 4 criteria.

For the purposes of the interim study, about 133 sites were evaluated in Steps 1 and 2. Of this amount, 24 survived the original screening levels. Plates V-2 through V-6 located at the end of this section show the general location of each of the sites. (In some instances a site may be both publicly owned and formerly used for disposal of dredged material.)

These 24 sites were then subjected to steps 3 and 4.

Step 3 - Preliminary Ranking of the Alternative Sites in Order of Desirability (Secondary Screening). Detailed site-specific information was collected for each of the sites surviving Step 2. The data was converted to representative numerical values which are analyzed by means of a matrix. This matrix incorporates an independent weighting system that lends emphasis to site specific data of particular importance.

Site Specific Criterion	Weighting Factor
1. Proximity of Site to Significant Ecological Areas	10
2. Bathymetry of Site/Available Volume	9
3. Exposure Considerations	7
4. Soil/Foundation Characteristics of Site	7
5. Existing & Potential Land Use	6
6. Volume & Types of Dredged Material Available for Containment	4
7. Compatibility with Adjacent Land/Re-use	2
8. Proximity of Site to Cultural Resources	2
9. Use of Site for Existing or Historic Dredged Material Disposal	1

The 24 potential sites were evaluated for each of the factors listed above, and were assigned criteria points based upon location within a specific evaluation item. For instance if a site is located greater than 3 miles from shellfish beds it would be given 2 criteria points. If it were within one mile, it would not get any points. These criteria points were then multiplied by the weighting factor to get an overall score. The greater the overall score, the lower the environmental impacts. A complete breakdown of criteria points and their significance is contained in the Interim Report. The full array of criteria, sub-criteria and weighting factors for all 24 sets is shown in Table V-1. The surviving 24 sites, ranked in order of numerical ratings, are shown on Figure V-7 There are 17 sites in New York (one of the sites is both publically owned and a former dredged material disposal site thus only 16 were evaluated), and 7 in Connecticut.

IT SHOULD BE NOTED THAT NONE OF THESE SITES WAS DISCUSSED WITH LOCAL INTERESTS BY THE CONSULTANT PERFORMING THESE STUDIES FOR THE CORPS. THEY HAVE NOT PROVEN TO BE THE BEST 24 (23) SITES FOR CONTAINMENT FACILITIES IN LONG ISLAND SOUND.

Of the sixteen sites in New York, eight are clustered in a small area in the Throgs Neck Bridge vicinity at the extreme western end of Long Island Sound. Six sites are located in Hempstead Harbor, one in Mamaroneck Harbor and one in Huntington Harbor.

Seven sites were screened in Connecticut, two in New Haven Harbor (identical to the sites mentioned in the Reconnaissance Report) one near Bridgeport Harbor (the third site considered in the Reconnaissance Report), two in New London, and one each in Norwalk Harbor and Byram Harbor.

The step 3 screening level reduced the 16 New York sites down to 5 sites (or groups of sites) which were recommended for further analysis. These sites are (1) the U.S. Naval Reservation (#10) and the New York State Merchant Marine Academy (#1) on Throgs Point; Little Bay Park (#4)

SUMMARY MATRIX FOR SITE-SP

NEW YORK SITES

CRITERIA	(Weight Factor)	Sub-Criteria	Total Pts. Possible	1-3	1-4	1-5	1-6	1-7	2-6	3-18	3-24
Proximity to Sensitive Ecological Areas (SEA's)	(10)	A	(2)	1x10=10	1x10=10	2x10=20	2x10=20	2x10=20	2x10=20	1x10=10	2x10=20
		B	(2)	1x10=10	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20
		C	(2)	1x10=10	0x10=0	1x10=10	1x10=10	1x10=10	1x10=20	2x10=20	1x10=10
		D	(2)	1x10=10	1x10=10	0x10=0	1x10=10	1x10=10	1x10=20	1x10=10	1x10=10
		E	(2)	1x10=10	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20
		Subtotal	(10)	5x10=50	6x10=60	7x10=70	8x10=80	8x10=80	8x10=80	8x10=80	8x10=80
Bathymetry of Site	(9)	A	(10)	2x 9=18	7x 9=63	7x 9=63	1x 9=9	7x 9=63	10x 9=90	0x 9=0	1x 9=9
Exposure Considerations	(7)	A	(3)	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21
		B	(3)	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21
		C	(2)	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	0x 7=0
		D	(2)	0x 7=0	2x 7=14	0x 7=0	1x 7=7	0x 7=0	1x 7=7	0x 7=0	1x 7=7
		Subtotal	(10)	8x 7=56	10x 7=70	8x 7=56	9x 7=63	8x 7=56	9x 7=63	8x 7=56	7x 7=49
Soil/Foundation Characteristics	(7)	A	(9)	9x 7=63	9x 7=63	9x 7=63	3x 7=21	6x 7=42	6x 7=42	9x 7=63	6x 7=42
		B	(1)	0x 7=0	1x 7=7	1x 7=7	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0
		Subtotal	(10)	9x 7=63	10x 7=70	10x 7=70	3x 7=21	6x 7=42	6x 7=42	9x 7=63	6x 7=42
Existing and Potential Land Use	(6)	A	(2)	1x 6=6	1x 6=6	1x 6=6	1x 6=6	1x 6=6	0x 6=0	1x 6=6	1x 6=6
		B	(2)	1x 6=6	1x 6=6	1x 6=6	1x 6=6	1x 6=6	2x 6=12	1x 6=6	2x 6=12
		C	(2)	2x 6=12	1x 6=6	2x 6=12	1x 6=6	2x 6=12	2x 6=12	1x 6=6	2x 6=12
		D	(2)	0x 6=0	0x 6=0	0x 6=0	0x 6=0	1x 6=6	0x 6=0	1x 6=6	0x 6=0
		E	(2)	1x 6=6	1x 6=6	2x 6=12	1x 6=6	0x 6=0	1x 6=6	1x 6=6	2x 6=12
		Subtotal	(10)	5x 6=30	4x 6=24	6x 6=36	4x 6=24	5x 6=30	5x 6=30	5x 6=30	7x 6=42
Volume and Types of Dredged Material Available (see Table 4-7)	(4)	A	(10)	3x 4=12	6x 4=24	8x 4=32	10x 4=40	4x 4=16	10x 4=40	0x 0=0	3x 4=12
Proximity to Cultural Resources	(2)	A	(10)	10x 2=20	10x 2=20	10x 2=20	10x 2=20	1x 2=2	10x 2=20	10x 2=20	0x 2=0
Land Reuse Potential	(2)	A	(2)	1x 2=2	1x 2=2	0x 2=0	1x 2=2	1x 2=2	1x 2=2	0x 2=0	1x 2=2
		B	(3)	2x 2=4	2x 2=4	3x 2=6	2x 2=4	0x 2=0	2x 2=4	2x 2=4	2x 2=4
		C	(3)	0x 2=0	1x 2=2	0x 2=0	1x 2=2	1x 2=2	0x 2=0	1x 2=2	0x 2=0
		D	(2)	1x 2=2	1x 2=2	2x 2=4	1x 2=2	1x 2=2	1x 2=2	2x 2=4	0x 2=0
		Subtotal	(10)	4x 2=8	5x 2=10	5x 2=10	5x 2=10	3x 2=6	4x 2=8	5x 2=10	3x 2=6
Use of Site for Existing or Historical Spoil Disposal	(1)	A	(7)	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
		B	(3)	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
		Subtotal	(10)	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
Total Points	(480)			257	341	357	267	295	373	259	240
Ranking				13	3	2	10	6	1	12	15

TABLE V-1

SITE-SPECIFIC EVALUATION OF POTENTIAL SITES

									CONNECTICUT SITES						
3-24	3-25	3-26	3-39	3-43	3-44 & 4-5	3-47	4-4	5-8	1-9	1-10	3-50	3-58	3-63	3-69	3-71
2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	0x10=0	0x10=0	0x10=0	1x10=10	0x10=0	0x10=0	0x10=0
2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	2x10=20	1x10=10	2x10=20	2x10=20	2x10=10	2x10=20	2x10=20	2x10=20	1x10=10	2x10=20	2x10=20
1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	2x10=20	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10
1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	1x10=10	2x10=20	1x10=10	1x10=10	1x10=10	1x10=10	2x10=20	2x10=20	1x10=10	1x10=10	1x10=10
2x10=20	2x10=20	2x10=20	2x10 20	2x10=20	1x10=10	1x10=10	2x10=20	2x10=20	2x10=10	2x10=20	1x10=10	1x10=10	2x10=20	2x10=20	2x10=20
8x10=80	8x10=80	8x10=80	8x10=80	8x10=80	7x10=70	7x10=70	8x10=80	8x10=80	6x10=60	7x10=70	6x10=60	7x10=70	5x10=50	6x10=60	6x10=60
1x 9=9	6x 9=54	7x 9=63	8x 9=72	4x 9=36	4x 9=36	0x 9=0	0x 9=0	0x 9=0	6x 9=54	1x 9=9	0x 9=0	1x 9=9	6x 9=54	5x 9=45	3x 9=27
3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	2x 7=14	2x 7=14	2x 7=14	3x 7=21	3x 7=21
3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	3x 7=21	2x 7=14	2x 7=14	3x 7=21	3x 7=21
0x 7=0	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	2x 7=14	3x 7=21	2x 7=14	2x 7=14	0x 7=0	1x 7=7	2x 7=14	2x 7=14	2x 7=14
1x 7=7	1x 7=7	1x 7=7	1x 7=7	0x 7=0	0x 7=0	1x 7=7	1x 7=7	0x 7=0	1x 7=14	1x 7=7	1x 7=7	0x 7=0	1x 7=7	1x 7=7	0x 7=0
7x 7=49	9x 7=63	9x 7=63	9x 7=63	8x 7=63	8x 7=56	9x 7=63	9x 7=63	8x 7=56	9x 7=63	9x 7=63	6x 7=42	5x 7=35	7x 7=49	9x 7=63	8x 7=56
6x 7=42	6x 7=42	6x 7=42	3x 7=21	3x 7=21	3x 7=21	0x 7=0	6x 7=42	6x 7=42	0x 7=0	0x 7=0	0x 7=0	0x 7=0	6x 7=42	3x 7=21	3x 7=21
0x 7=0	0x 7=0	0x 7=0	1x 7=7	0x 7=0	0x 7=0	1x 7=7	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0	0x 7=0
6x 7=42	6x 7=42	6x 7=42	4x 7=28	3x 7=21	3x 7=21	1x 7=7	6x 7=42	6x 7=42	0x 7=0	0x 7=0	0x 7=0	0x 7=0	6x 7=42	3x 7=21	3x 7=21
1x 6=6	0x 6=0	1x 6=6	0x 6=0	2x 6=12	1x 6=6	1x 6=6	1x 6=6	1x 6=6	1x 6=6	1x 6-6	1x 6-6	2x 6=12	1x 6=6	1x 6=6	1x 6=6
2x 6=12	2x 6=12	0x 6=0	0x 6=0	0x 6=0	1x 6=6	1x 6=6	0x 6=0	0x 6=0	1x 6=6	1x 6=6	0x 6=0	0x 6=0	0x 6=0	0x 6=0	0x 6=0
2x 6=12	2x 6=12	2x 6=12	1x 6=6	2x 6=12	2x 6=12	2x 6=12	1x 6=6	1x 6=6	1x 6=6	1x 6=6	1x 6=6	2x 6=12	1x 6=6	1x 6=6	1x 6=6
0x 6=0	0x 6=0	1x 6=6	1x 6=6	0x 6=12	1x 6=6	0x 6=0	1x 6=6	1x 6=6	1x 6=6	1x 6=6	2x 6=12	0x 6=0	1x 6=6	1x 6=6	2x 6=12
2x 6=12	0x 6=0	2x 6=12	2x 6=12	2x 6=12	0x 6=0	2x 6=12	1x 6=6	1x 6=6	0x 6=0	1x 6=6	1x 6=6	2x 6=12	0x 6-0	1x 6=6	1x 6=6
7x 6=42	4x 6=24	6x 6=36	4x 6=24	6x 6=36	5x 6=30	6x 6=36	4x 6=24	4x 6=24	4x 6=24	5x 6=30	5x 6=30	6x 6=36	3x 6=18	4x 6=24	5x 6=30
3x 4=12	2x 4=8	2x 4=8	7x 4=28	5x 4=20	5x 4=20	1x 4=4	7x 4=28	1x 4=4	6x 4=24	5x 4=20	1x 4=4	3x 4=12	8x 4=32	7x 4=28	10x 4=40
0x 2=0	0x 2=0	1x 2=2	10x 2=20	5x 2=10	5x 2=10	5x 2=10	10x 2=20	10x 2=20	10x 2=20	10x 2=20	1x 2=2	5x 2=10	10x 2=20	10x 2=20	10x 2=20
1x 2=2	1x 2=2	1x 2=2	1x 2=2	2x 2=4	0x 2=0	1x 2=2	0x 2=0	1x 2=2	2x 2=4	1x 2=2	1x 2=2	1x 2=2	0x 2=0	0x 2=0	2x 2=4
2x 2=4	2x 2=2	2x 2=4	3x 2=6	3x 2=6	3x 2=6	3x 2=6	2x 2=4	2x 2=4	3x 2=6	3x 2=6	3x 2=6	3x 2=6	2x 2=4	3x 2=6	3x 2=6
0x 2=0	0x 2=0	1x 2=2	1x 2=2	0x 2=0	1x 2=2	0x 2=0	1x 2=2	1x 2=2	3x 2=6	1x 2=2	3x 2=6	0x 2=0	1x 2=2	3x 2=6	3x 2=6
0x 2=0	0x 2=0	0x 2=0	2x 2=4	0x 2=0	1x 2=2	0x 2=0	2x 2=4	2x 2=4	1x 2=2	1x 2=2	1x 2=2	0x 2=0	2x 2=4	2x 2=4	1x 6=6
3x 2=6	3x 2=6	4x 2=8	7x 2=14	5x 2=10	5x 2=10	4x 2=8	5x 2=10	6x 2=12	9x 2=18	6x 2=12	8x 2=16	4x 2=8	5x 2=10	8x 2=16	9x 6=18
0x 1=0	4x 1=4	4x 1=4	0x 1=0	0x 1=0	4x 1=4	0x 1=0	4x 1=4	4x 1=4	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
0x 1=0	2x 1=2	2x 1=2	0x 1=0	0x 1=0	3x 1=3	0x 1=0	2x 1=2	1x 1=1	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
0x 1=0	6x 1=6	6x 1=6	0x 1=0	0x 1=0	7x 1=7	0x 1=0	6x 1=6	5x 1=5	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0	0x 1=0
240	283	308	329	276	260	198	273	243	263	224	154	180	275	277	272
15	7	5	4	8	11	16	9	14	4	5	7	6	2	1	3

2

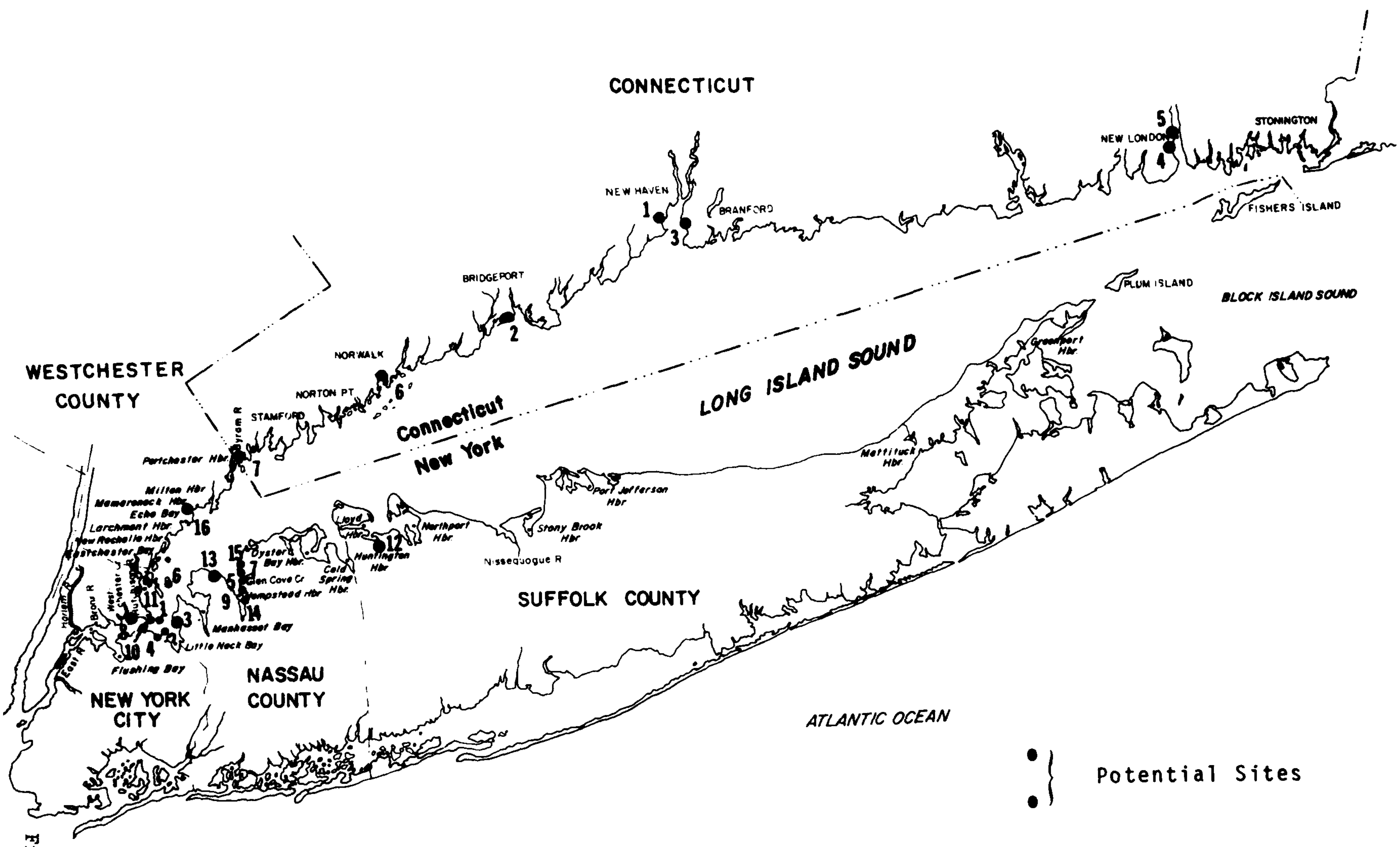


Figure V-7

LOCATIONS OF POTENTIAL SITES SURVIVING PRIMARY SCREENING

and Fort Totten Military Reservation (#2) on Willets Point; Morgan Memorial Park (#15), Garvies Point Preserve (#7) and Garvies Point Park (#5) on the east side of Hampstead Harbor near Glen Cove Creek; a U.S. Military Reservation (#6) on Hart Island; and Ferry Point Park (#8) in the Upper East River.

The top 3 sites in Connecticut recommended for further analysis are Bayview Park (#1) in New Haven Harbor; Seaside Park (#2) in Bridgeport, and East Shore Park (#3) in New Haven, (again all these were evaluated in the Reconnaissance Report. All were rejected by State officials).

Step 4 - Detailed Investigations of Individual Sites or in Combinations to Determine the Potential of Using More Than One Site. Only one site in each State was investigated in detail, each the top rated site.

The New York State Merchant Marine Academy is shown on Figure V-8. The Bayview Park (Long Wharf area) is shown on Figure V-9. Full explanations of the consultant's findings for each site are described in the Interim Report. Neither is being suggested for further study at this time. There are very significant oyster seed areas in the immediate vicinity of Long Wharf. It is also a prime feeding area for gulls and terns and is one of the largest undisturbed mud flat areas in Connecticut. Similarily, New York State DEC has indicated that there would be significant ecological harm if the containment facility were sited at the Throgs Neck sites.

In summary, after coordinating the findings of the Interim Report with appropriate State officials, there was no acceptable containment facility of the type as formulated in this Interim Report. Reformulation of alternative sites was necessary.

Addendum to Interim Report

This phase of the plan formulation efforts centered on evaluation of 121 additional shoreline and near shore sites. These sites consist of the following groupings.

18 Shallow Water Sites
31 Municipal Waste Water Treatment Plates
14 Power Generating Sites
21 Corps Navigation Projects with Jetties and Breakwaters
11 Industrial Wastewater Discharges
20 Petroleum Facilities
4 Sand and Gravel Pits.

The location of these sites are shown on Plates V-2 through V-6 at the end of this section. Full descriptions of each site are contained in the Addendum to the Interim Report (March 1981). They are also listed on Table V-2.

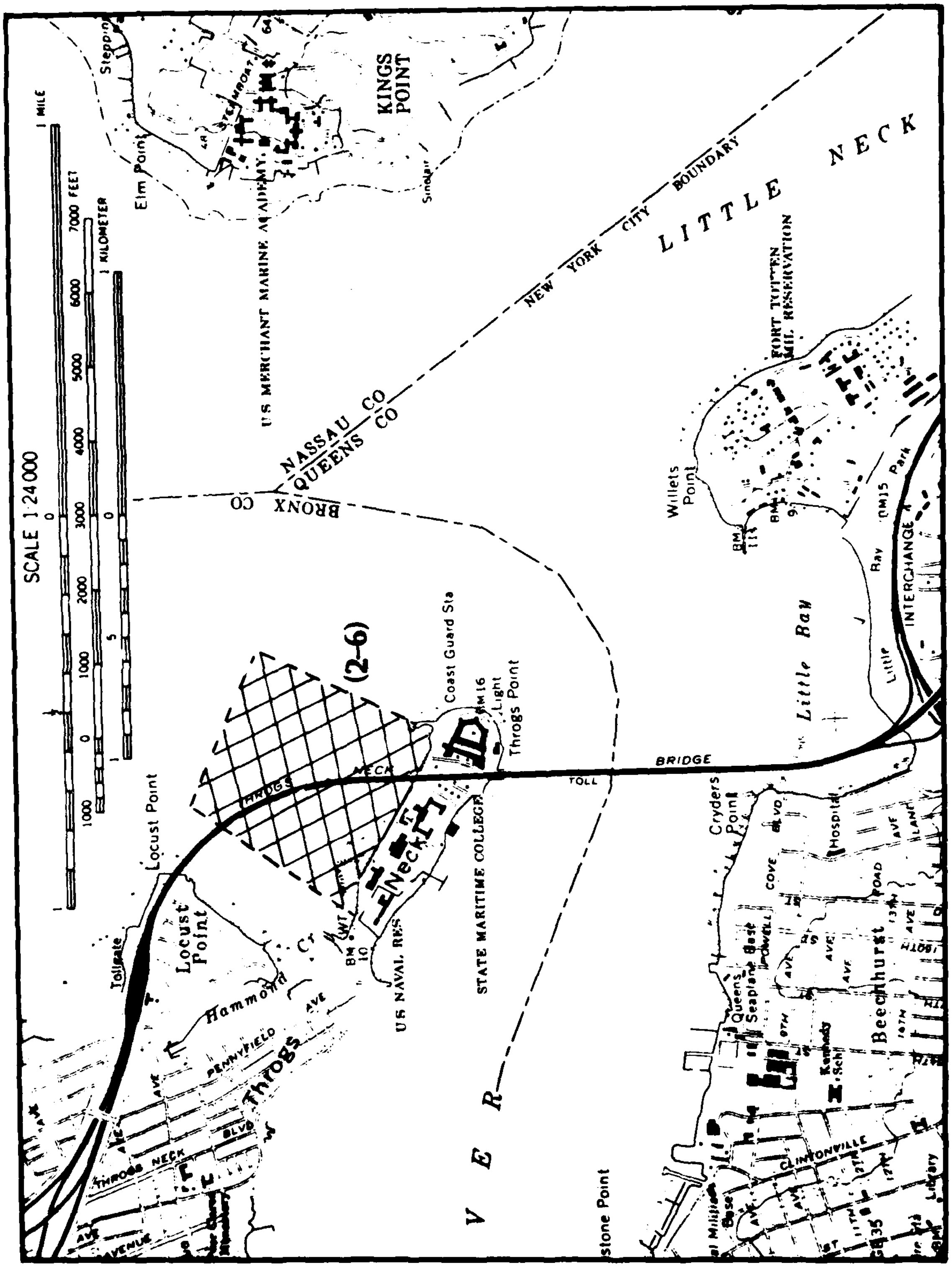
The above 121 sites were evaluated using a combined step 1 - Step 2 criteria as derived in the Interim Report. The fourth step was not applied to this analysis. Only 3 criteria were deemed critical for this phase of the analysis; bathymetry; ecologically significant areas, and public beaches. However, no site could be eliminated from consideration because of ecological concerns unless field proofing of the site was made for verification. Of the originally investigated sites, 54 sites were ruled out because of either insufficient shorefront under direct control, or a total volume available for disposal of less than 200,000 cubic yards.

No sites were ruled out because of ecological concerns although 27 would have been ruled out using the criteria established in the interim report. In addition to the 54 sites eliminated because of insufficient volumes, 8 sites were also eliminated because of close proximity to a public beach. The remaining 59 sites were subjected to a step 3 evaluation and matrix analysis, 43 are in Connecticut. Step 3 is briefly described under the Interim Report description or in detail in the Interim Report.

The overall ranking of the 43 Connecticut sites, plus as a comparison the six step 3 sites from the Interim Report, are shown on Table V-3. The individual ranking of each site is shown, along with a possible group ranking (such as if several sites are adjacent to one another. They would be combined into one group rather than analyzed as 2 or 3 separate sites). Table V-4, the Summary of Secondary Siting Analysis in Connecticut, shows how each site grouping compared to one another. Generally shallow water areas were the most unfavorable for consideration as potential containment facility sites whereas industrial sites appeared to be best suited.

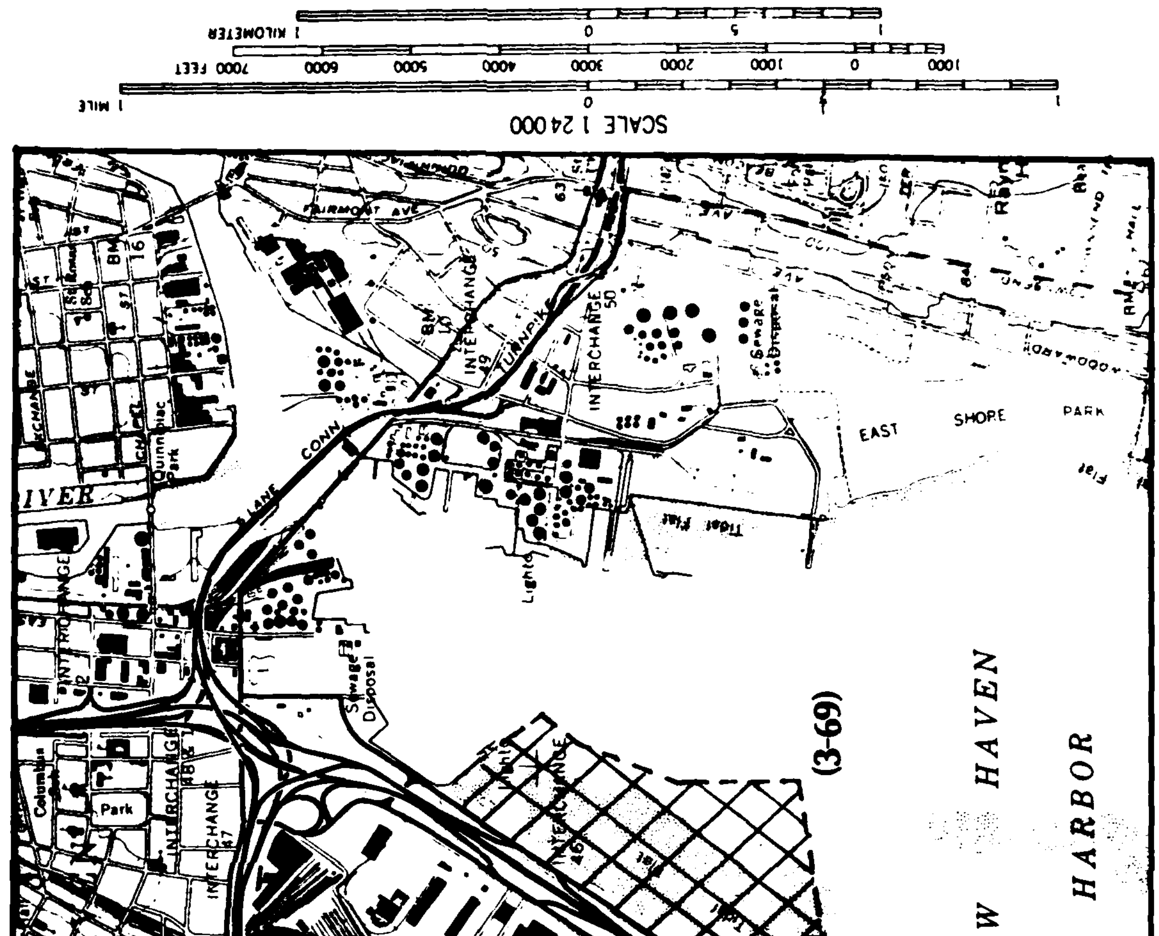
The top 10 ranking sites in Connecticut are listed on Table V-5. Nineteen New York sites underwent secondary site screening in addition to a relisting of the 15 sites analyzed in the Interim Report. They are listed on Table V-6. As with the Connecticut sites each is compared to one another and also to study groups. Table V-7, the Summary of Secondary Siting Analysis in New York, relates each site group to one another. As with the Connecticut sites, the shallow water sites had the lowest overall ranking. However, public sites offered, in the consultant's opinion, the most potential for a containment site. Table V-8 lists the top 10 ranked groupings in New York.

Another secondary siting analysis was then performed on all sites advancing to Step 3. However, the weighting factors were changed to reflect a more cost conscious approach. Tables V-9 and V-10 are the weighting factor summaries for the Connecticut and New York sites. Each shows how the sites fared under present analysis and under the initial screening. Generally, there were few significant changes although some sites moved up or down in overall ranking by several places. The listing of the top 10 sites in Connecticut based upon the combined two-stage step 3 analysis as shown in Table V-11, and their locations are depicted on



TOP RANKING NEW YORK SITE AT THROGS NECK

Figure V-8



TOP RANKING CONNECTICUT SITE IN NEW HAVEN HARBOR

Figure V-9

TABLE V-2

SITE INFORMATION BY CATEGORY

I. Shallow Water Areas

Name of Site	Site No.	Quadrangle Location	Quad. No.
Centre Island (North)	1-1	Bayville, NY-CT	7
Centre Island (East)	1-2	Bayville, NY-CT	7
Hoyt Island	1-3	Norwalk South, CT	18
Harborview	1-4	Norwalk South, CT	18
Kelsey Island	1-5	Bramford, CT	30
Indian Neck	1-6	Bramford, CT	30
Guilford Harbor, West	1-7	Guilford, CT	31
Guilford Harbor, East	1-8	Guilford, CT	31
Hammonasset River Tidal Flats	1-9	Clinton, CT	32
Cedar Island Flats	1-10	Clinton, CT	32
Clinton Harbor, West	1-11	Clinton, CT	32
Clinton Harbor, East	1-12	Clinton, CT	32
Rock Creek, South	1-13	Old Lyme, CT	34
Rock Creek, North	1-14	Old Lyme, CT	34
Lyme Station Tidal Flats	1-15	Old Lyme, CT	34
Great Island	1-16	Old Lyme, CT	34
Griswold Point	1-17	Old Lyme, CT	34
Barn Island Hunting Area	1-18	Mystic, CT & Watch Hill, RI-CT	38

II. Municipal Waste Water Treatment Facilities

Name of Facility	Site No.	Quadrangle Location	Quad. No.
Port Jefferson	2-1	Port Jefferson, NY	11
San Remo	2-2	Saint James, NY	10
Northport	2-3	Northport, NY	9
Huntington	2-4	Lloyd Harbor, NY	8
Oyster Bay	2-5	Bayville, NY	7
Glen Cove	2-6	Sea Cliff, NY	2
Roslyn	2-7	Sea Cliff, NY	2
Port Washington	2-8	Sea Cliff, NY	2
Great Neck	2-9	Sea Cliff, NY	2
Great Neck (V)	2-10	Sea Cliff, NY	2
Little Neck	2-11	Sea Cliff, NY	2
Tallman Island	2-12	Flushing, NY	1
City - Hart Island	2-13	Flushing, NY	1
New Rochelle	2-14	Mount Vernon, NY	5
Mamaroneck	2-15	Mamaroneck, NY	6
Greenwich	2-16	Glenville, CT-NY	16
Stamford	2-17	Stamford, CT	17
Darien	2-18	Norwalk South, CT	18
Norwalk	2-19	Norwalk South, CT	18
Bridgeport-West Side	2-20	Bridgeport, CT	24
Bridgeport-East Side	2-21	Bridgeport, CT	24
Stratford	2-22	Bridgeport, CT	24
Milford-Gulf Pond	2-23	Milford, CT	25
West Haven	2-24	New Haven, CT	29
New Haven-Blvd.	2-25	New Haven, CT	29
New Haven-East St.	2-26	New Haven, CT	29
New Haven-East Side	2-27	New Haven, CT	29
Branford	2-28	Branford, CT	30
New London-Riverside Plant	2-29	Uncasville, CT	above 36
New London-Trumbull St.	2-30	New London, CT	36
City of Groton	2-31	New London, CT	36

TABLE V-2 (Cont.)

SITE INFORMATION BY CATEGORY

III. Power Generating Stations

Plant	Ownership	Site No.	Quad. Location	Quad. No.
Fisher Island	Fisher Island El.	3-1	New London, CT	36
Southold	Long Island Lt.	3-2	Southold, NY	21
Shoreham	Long Island Lt.	3-3	Wading River, NY	13
Port Jefferson	Long Island Lt.	3-4	Port Jefferson, NY	11
Northport	Long Island Lt.	3-5	Northport, NY	9
Glenwood	Long Island Lt.	3-6	Sea Cliff, NY	2
Cos Cob	Ct. L & P	3-7	Stamford, CT	17
South Norwalk	South Norwalk Mun.	3-8	Norwalk South, CT	18
Norwalk Harbor	Ct. L & P	3-9	Norwalk South, CT	18
Bridgeport Harbor	United Illum	3-10	Bridgeport, CT	24
Steel Point	United Illum	3-11	Bridgeport, CT	24
Devon	Ct. L & P	3-12	Milford, CT	25
English	United Illum	3-13	New Haven, CT	29
Millstone	Millstone Point Co.	3-14	Niantic, CT	35

IV. Corps Navigation Projects with Jetties or Breakwaters

Name of Harbor		Site No.	Quad. Location	Quad. No.
Mattituck Harbor	Jetties	4-1	Mattituck Hills, NY	20
Mt. Sinai Harbor	Jetties	4-2	Port Jefferson, NY	11
Port Jefferson Harbor	Jetties	4-3	Port Jefferson, NY	11
Hempstead Harbor	Breakwaters	4-4 a,b	Sea Cliff, NY	2
Flushing Bay & Creek	Dike	4-5	Flushing, NY	1
New Rochelle Harbor	Breakwaters	4-6	Mt. Vernon, NY	5
Echo Bay	Breakwaters	4-7	Mt. Vernon, NY	5
Larchmont Harbor	Breakwaters	4-8	Mamaroneck, NY	6
Port Chester Harbor	Breakwaters	4-9	Mamaroneck, NY	6
Stamford Harbor	Breakwaters	4-10	Stamford, CT	17
Cove Island, Stamford	Jetty	4-11	Stamford, CT	17
Southport Harbor	Breakwaters	4-12	Westport, CT	23
Black Rock Harbor, Bridgeport	Breakwaters	4-13	Bridgeport, CT	24
Bridgeport Harbor	Breakwaters	4-14	Bridgeport, CT	24
Housatonic River, Stratford	Breakwaters	4-15	Milford, CT	25
Woodmont Shore, Milford	Groins	4-16	Woodmont, CT	26
New Haven Harbor	Breakwaters	4-17 a,b	New Haven, CT	26
Clinton Harbor	Breakwaters	4-18	Clinton, CT	32
Duck Island Harbor	Breakwaters	4-19	Essex, CT	33
Conn. River, Saybrock	Jetty	4-20	Old Lyme, CT	34
Stonington Harbor	Breakwaters	4-21	Mystic, CT	37

V. Industrial Wastewater Discharges

Discharger/Industry	Site No.	Quadrangle Location	Quad. No.
Long Island Tungsten - Metal	5-1	Sea Cliff, NY	2
Powers Chemco Inc. - Organic Chemicals	5-2	Sea Cliff, NY	2
Electrolux - Metal Services	5-3	Stamford, CT	17
Remington Electric - Metal Plating	5-4	Bridgeport, CT	24
Carpenter Technology Co. - Steel Mill	5-5	Bridgeport, CT	24
Avco: Lycoming	5-6	Bridgeport/Milford, CT	24/25
Schick Safety Razor - Metal Plating	5-7	Milford, CT	25
Sargent & Co. - Metal Services	5-8	New Haven, CT	29
Atlantic Wire Co. - Steel & Wire	5-9	Branford, CT	30
Pfizer Co. - Chemical	5-10	New London, CT	36
American Velvet Co. - Textiles	5-11	Mystic, CT	37

TABLE V-2 (Cont.)

SITE INFORMATION BY CATEGORY

VI. Petroleum Facilities

Name of Facility	Site No.	Quadrangle Location	Quad. No.
	6-1	Mattituck Hills, NY	20
Northville Industries	6-2	Riverhead, NY	14
Swezy Oil Co. Exxon Consolidated Petroleum Co. Mobil Oil Co. Northville Industries	6-3	Port Jefferson, NY	11
Huntington Utilities	6-4	Lloyd Harbor, NY	8
Mobil Oil Co.	6-5	Huntington, NY	4
Commander Oil Co.	6-6	Bayville, NY	7
Windsor Oil Co.	6-7	Sea Cliff, NY	2
Phillips Oil Co.	6-8	Sea Cliff, NY	2
Lewis Oil Co. Mobil Oil Co. Auto Heat	6-9	Sea Cliff, NY	2
Metropolitan Petroleum Co. Universal Utilities Wharf Sinclair Refining Co. Wells Fuel Wharf	6-10	Sea Cliff, NY	2
Sun Oil Co.	6-11	Mt. Vernon, NY	5
Mitchell Oil Co.	6-12	Mamaroneck, NY	6
Fleming Rutledge Oil Corp. Hoffman Fuel Co. Metropolitan Petroleum Corp.	6-13	Stamford, CT	17
Penn. Petroleum Co.	6-14	Norwalk South, CT	18
Sun Oil Co.	6-15	Bridgeport, CT	24
Connecticut Refining Co.	6-16	New Haven, CT	29
Elm City Plant No. 3	6-17	New Haven, CT	29
Atlantic Richfield Exxon Getty Oil Co. Gulf Oil Corp. New Haven Terminal T.A.D. Jones & Co., Inc.	6-18	New Haven, CT	29
City Coal Co. Central Vermont Railroad	6-19	New London, CT	36
Hess Oil Co.	6-20	New London, CT	36

VII. Sand and Gravel Pits

Name of Site	Site No.	Quadrangle Location	Quad. No.
Jamesport - LILCO	7-1	Mattituck, NY	15
Huntington Harbor	7-2	Lloyd Harbor, NY	8
Colonial Sand & Stone, Penn Ind.	7-3	Sea Cliff, NY	2
Old Saybrook	7-4	Essex, CT	33

CRITERIA	(Weight Factor)	Sub-Criteria	Total Pts. Possible	1-3	1-4	1-5	1-7	1-8	1-11	1-12	1-13	1-14	1-16	1-17
Proximity to Sensitive Ecological Areas (SEA's)	(10)	A	(2)	0	0	0	0	0	0	0	0	0	0	0
		B	(2)	20	20	20	0	0	0	0	10	10	0	0
		C	(2)	10	10	10	0	0	0	0	0	10	0	0
		D	(2)	20	10	10	20	20	0	0	0	0	0	0
		E	(2)	0	0	20	0	0	0	0	0	0	0	0
		Subtotal	(10)	50	40	60	20	20	0	0	10	20	0	0
Bathymetry of Site	(9)	A	(10)	27	27	63	72	36	90	45	36	36	90	36
Exposure Considerations	(7)	A	(3)	14	14	14	0	0	14	14	14	14	14	21
		B	(3)	21	21	0	0	0	0	0	21	21	21	21
		C	(2)	0	0	0	0	0	0	0	0	0	0	0
		D	(2)	7	7	7	0	0	0	7	0	0	0	0
		Subtotal	(10)	42	42	21	0	0	14	21	35	35	35	42
Soil/Foundation Characteristics	(7)	A	(9)	0	0	63	0	0	0	0	0	0	0	0
		B	(1)	7	7	7	7	7	7	7	7	7	7	7
		Subtotal	(10)	7	7	70	7	7	7	7	7	7	7	7
Existing and Potential Land Use	(6)	A	(2)	6	0	0	0	0	0	0	0	6	0	0
		B	(2)	6	0	0	0	0	0	0	0	0	0	0
		C	(2)	6	12	6	6	6	6	6	6	6	12	6
		D	(2)	12	12	0	6	6	0	0	6	0	0	0
		E	(2)	6	6	12	12	12	12	12	6	12	12	12
		Subtotal	(10)	36	30	18	24	24	18	18	18	24	24	18
Volume and Types of Dredged Material Available (see Table 4-7)	(4)	A	(10)	8	8	16	12	12	12	12	32	32	32	32
Proximity to Cultural Resources	(2)	A	(10)	10	10	20	10	10	10	2	2	2	2	10
Land Reuse Potential	(2)	A	(2)	2	4	2	2	2	2	2	2	2	2	0
		B	(3)	4	4	0	4	2	0	4	0	0	0	2
		C	(3)	2	6	0	2	2	2	2	0	0	6	2
		D	(2)	0	0	0	0	0	4	2	0	0	0	0
		Subtotal	(10)	8	14	2	8	6	8	10	2	2	8	4
Use of Site for Existing or Historical Spoil Disposal	(1)	A	(7)	4	4	0	0	0	0	4	4	0	0	0
		B	(3)	2	2	0	0	0	0	0	0	0	0	0
		Subtotal	(10)	6	6	0	0	0	0	4	4	0	0	0
Total Points	(480)			194	184	270	153	106	159	119	146	178	198	149
Ranking (Within Site Group)				3	4	1	8	12	7	11	10	6	2	9
Ranking (Overall, 49 Sites)				26	28	5(b)	37	41	34	40	39	30	23	38

TABLE V-3

SUMMARY OF MATRIX FOR SITE-SPECIFIC EVALUATION
OF POTENTIAL SITES IN CONNECTICUT

	1-17	1-18	2-16	2-18	2-20	2-22	2-24	(P3-69) 2-25	2-26	2-27	2-29	2-30	3-7	3-9	3-13	3-14	4-10	4-13	4-14	4-15	4-17a	4-17b	4-18	4-19	4-20	4-21
	0	0	10	0	0	0	0	0	10	0	0	0	0	10	0	0	0	0	0	0	0	0	10	10	0	0
	0	0	10	10	20	10	20	20	20	20	20	20	10	20	20	0	0	20	20	0	20	20	10	10	0	0
	0	0	10	0	10	10	0	10	10	10	20	10	10	10	10	0	0	10	10	0	0	0	0	0	0	10
	0	0	20	20	10	0	10	10	10	10	10	0	10	20	0	0	10	10	0	0	0	0	0	10	0	0
	0	0	20	20	20	0	20	20	20	20	20	20	0	20	20	20	20	10	0	10	20	10	10	20	10	10
	0	0	70	50	60	20	50	60	70	60	70	50	30	80	50	20	30	50	30	10	40	30	30	50	10	20
	36	90	9	27	9	36	27	90	36	72	27	9	54	9	18	18	81	63	81	36	90	90	45	90	36	45
	21	21	21	14	21	21	14	21	21	21	21	21	21	21	21	0	14	14	14	0	14	0	14	0	0	14
	21	21	21	21	21	21	0	21	21	21	21	21	21	21	21	14	14	0	14	0	0	14	14	0	14	21
	0	0	0	0	0	0	0	14	0	14	14	14	0	0	0	14	14	0	0	14	0	14	14	14	14	14
	0	0	7	7	7	14	7	7	7	0	0	0	0	7	0	0	0	0	14	7	7	14	0	7	0	0
	42	42	49	42	49	56	21	63	49	56	56	56	42	49	42	28	42	14	42	21	21	42	42	21	28	49
	0	0	0	42	0	0	21	21	21	21	21	0	21	0	21	63	42	21	21	0	21	42	0	21	21	42
7	7	7	7	7	7	7	7	0	0	0	7	7	7	7	0	7	0	0	0	7	7	0	7	7	7	0
7	7	7	7	49	7	7	28	21	21	21	28	7	28	7	21	70	42	21	21	7	28	42	7	28	28	42
	0	12	0	0	0	0	0	6	6	6	0	0	0	0	6	0	0	0	6	0	0	0	0	12	0	0
	0	0	0	0	0	0	0	0	12	0	6	6	0	0	0	12	12	0	0	0	0	0	0	12	0	0
12	6	0	12	0	12	12	12	6	12	6	12	12	6	6	12	12	0	6	12	0	12	0	0	0	0	0
	0	0	6	0	12	12	6	6	12	12	12	12	6	6	12	0	0	0	12	0	6	0	0	0	0	6
12	12	12	6	6	12	12	12	6	12	6	6	6	12	6	12	12	12	12	12	6	12	12	6	12	12	12
	18	24	24	6	36	36	30	24	54	30	36	36	24	18	42	36	24	18	42	6	30	12	6	36	12	18
	32	4	4	8	16	20	40	40	40	40	24	24	4	12	40	12	8	16	16	12	40	20	12	16	32	8
2	10	10	10	20	20	10	10	20	20	20	20	20	20	10	20	20	10	20	2	2	2	2	10	10	10	10
2	0	0	4	2	4	4	0	0	4	4	4	2	2	2	4	4	2	2	4	2	2	2	2	2	2	2
	2	4	6	6	2	4	4	6	6	6	4	4	2	4	4	2	0	4	6	0	2	0	0	0	0	0
6	2	0	6	0	6	6	6	6	6	6	6	6	2	2	6	6	0	0	6	0	6	0	0	0	0	6
	0	0	2	0	0	0	2	4	2	6	0	2	0	4	2	0	2	0	4	0	4	4	2	0	0	0
	4	4	18	8	12	14	12	16	18	18	14	14	6	12	16	12	4	6	20	2	14	6	4	2	2	8
	0	0	4	0	4	4	0	0	4	0	4	4	4	4	4	0	0	4	2	0	0	0	0	0	0	0
	0	0	1	0	1	2	0	0	1	0	1	1	1	2	2	0	0	2	1	0	0	0	0	0	0	0
	0	0	5	0	5	6	0	0	5	0	5	5	5	6	6	0	0	6	3	0	0	0	0	0	0	0
	149	181	196	210	160	187	218	334	313	317	280	221	213	203	255	216	241	214	257	96	265	244	156	253	158	200
2	9	5	8	7	10	9	6	1	3	2	4	5	3	4	1	2	5	6	2	10	1	4	9	3	8	7
23	38	29	24	20	32	27	16(b)	1(c)	3	2(b)	4	15	19	21	10(b)	17	14	18	9	42	6	12	36	11	35	22

2

LUATION

													P3-69		6-17								P3-72
13	3-14	4-10	4-13	4-14	4-15	4-17a	4-17b	4-18	4-19	4-20	4-21	5-4	5-8	6-14	6-16	6-18	6-20	P1-9	P1-10	P3-50	P3-58	P3-69	P3-71
0	0	0	0	0	0	0	0	10	10	0	0	0	0	0	0	10	0	0	0	0	10	0	0
20	0	0	20	20	0	20	20	10	10	0	0	20	20	20	20	20	20	20	20	20	20	20	20
10	0	0	10	10	0	0	0	0	0	0	10	10	10	10	10	10	10	10	20	10	10	10	10
0	0	10	10	0	0	0	0	0	10	0	0	0	10	10	10	10	0	10	10	20	20	10	10
20	20	20	10	0	10	20	10	10	20	10	10	20	20	0	0	20	20	20	20	10	10	20	20
50	20	30	50	30	10	40	30	30	50	10	20	50	60	40	40	70	50	60	70	60	70	60	60
18	18	81	63	81	36	90	90	45	90	36	45	36	90	18	27	9	27	9	36	9	9	90	72
21	0	14	14	14	0	14	0	14	0	0	14	21	21	14	21	21	21	21	21	14	14	21	21
21	14	14	0	14	0	0	14	14	0	14	21	21	21	21	21	21	21	21	21	21	14	21	21
0	14	14	0	0	14	0	14	14	14	14	14	0	14	0	0	0	14	14	14	0	7	14	14
0	0	0	0	14	7	7	14	0	7	0	0	14	7	0	7	7	0	14	7	7	0	7	0
42	28	42	14	42	21	21	42	42	21	28	49	56	63	35	49	49	56	63	63	42	35	63	56
21	63	42	21	21	0	21	42	0	21	21	42	21	21	21	21	21	0	0	0	0	0	21	21
0	7	0	0	0	7	7	0	7	7	7	0	7	0	7	7	0	7	0	0	0	0	0	0
21	70	42	21	21	7	28	42	7	28	28	42	28	21	28	28	21	7	0	0	0	0	21	21
6	0	0	0	6	0	0	0	0	12	0	0	6	6	6	0	6	0	6	6	6	12	6	6
0	12	12	0	0	0	0	0	0	12	0	0	0	0	0	0	0	6	6	6	0	0	0	0
12	12	0	6	12	0	12	0	0	0	0	0	12	6	0	12	12	12	6	6	6	12	6	6
12	0	0	0	12	0	6	0	0	0	0	6	12	6	12	12	12	12	6	6	12	0	6	12
12	12	12	12	12	6	12	12	6	12	12	12	12	6	12	6	12	12	0	6	6	12	6	6
42	36	24	18	42	6	30	12	6	36	12	18	42	24	30	30	42	42	24	30	30	36	24	30
40	12	8	16	16	12	40	20	12	16	32	8	16	40	12	40	40	24	24	24	4	8	40	40
20	20	10	20	2	2	2	2	10	10	10	10	10	20	10	20	20	20	20	20	2	10	20	20
4	4	2	2	4	2	2	2	2	2	2	2	4	0	4	4	4	4	4	2	2	2	0	4
4	2	0	4	6	0	2	0	0	0	0	0	4	6	4	6	6	4	6	6	6	6	6	6
6	6	0	0	6	0	6	0	0	0	0	6	6	6	6	6	6	6	6	2	6	0	6	6
2	0	2	0	4	0	4	4	2	0	0	0	4	4	2	2	2	2	2	2	2	0	4	6
16	12	4	6	20	2	14	6	4	2	2	8	18	16	16	18	14	16	18	12	16	8	16	18
4	0	0	4	2	0	0	0	0	0	0	0	4	0	4	4	4	0	0	0	0	0	0	0
2	0	0	2	1	0	0	0	0	0	0	0	2	0	2	2	1	0	0	0	0	0	0	0
6	0	0	6	3	0	0	0	0	0	0	0	6	0	6	6	5	0	0	0	0	0	0	0
255	216	241	214	257	96	265	244	156	253	158	200	262	334	195	258	270	242	218	255	163	176	334	317
1	2	5	6	2	10	1	4	9	3	8	7	2	1	4	2	1	3	4	3	6	5	1	2
10(b)	17	14	18	9	42	6	12	36	11	35	22	7	1(b)	25	8	5(a)	13	16(a)	10(a)	33	31	1(a)	2(a)

TABLE V-4

SUMMARY OF SECONDARY SITING ANALYSIS IN CONNECTICUT

Site Group	No. Sites	Average Pts. Scored		Range of Pts. Scored	Total Pts. Possible
1. Shallow Water Areas	12	170 (215)	35% (36%)	106-270 (148-267)	480 (590)
2. Treatment Plants	10	243 (326)	51% (55%)	160-334 (209-426)	480 (590)
3. Power Plants	4	222 (274)	46% (46%)	203-255 (219-363)	480 (590)
4. Corps Nav. Projects	10	208 (243)	43% (41%)	96-265 (116-345)	480 (590)
5. Industrial Discharges	2	298 (383)	62% (65%)	262-334 (342-423)	480 (590)
6. Petroleum Facilities	5	241 (328)	50% (56%)	195-270 (261-368)	480 (590)
7. Sand & Gravel	0	- (-)		- (-)	- (-)
8. Public Sites*	6	255 (328)	53% (56%)	163-334 (213-423)	480 (590)
Total	49 (49)	221 (281)	46% (48%)	106-334 (116-426)	480 (590)

( ) Criteria Points Scored Under Second Set of Weighting Factors
* Public Sites Previously Analyzed in Interim Report

TABLE V-5

TOP TEN RANKING SITES IN CONNECTICUT

Rank	Score %	Site No.	Name of Site	Waterway	Quad Map No.	Map
1(a)		P3-69	Bayview Park	New Haven H.	29	B
(b)	70	5-8	Sargent & Co.	New Haven H.	29	B
(c)		2-25	New Haven Blvd.*	New Haven H.	29	B
2(a)	66	P3-71, P3-72	East Shore & Nathan Hale Parks	New Haven H.	29	B
(b)		2-27	New Haven-East Side*	New Haven H.	29	B
3	65	2-26	New Haven-East St.*	New Haven H.	29	B
4	58	2-29	Riverside Plant*	New London	36	D
5(a)	56	6-18	Oil Terminals	New Haven H.	29	B
(b)		1-5	Kelsey Island	Branford	30	C
6	55	4-17a	Breakwater	New Haven H.	29	B
7	55	5-4	Remington Electric	Bridgeport H.	24	B
8(a)	54	6-16	Connecticut Refining Co.			
(b)		6-17	& Elm City Plant No. 3	New Haven H.	29	B
9	54	4-14	Breakwaters	Bridgeport H.	24	B
10(a)	53	P1-10	U.S. Coast Guard Academy	New London	36	D
(b)		3-13	United Illuminating-English	New Haven H.	29	B

* Municipal Wastewater Treatment Plant

SUMMARY MATRIX FOR SITE-SPECIFI

CRITERIA	(Weight Factor)	Sub-Criteria	Total Pts. Possible	1-1	1-2	2-11	2-12	2-13	2-14	P5-2 4-3	4-4(a)	4-4(b)	4-5	4-6
									NEW YORK SITES					
Proximity to Sensitive Ecological Areas (SEA's)	(10)	A	(2)	0	0	20	20	20	20	20	20	20	20	20
		B	(2)	10	10	20	20	10	10	20	0	.0	20	10
		C	(2)	0	0	10	10	0	0	10	0	0	20	0
		D	(2)	0	0	0	10	10	20	0	0	0	20	10
		E	(2)	0	0	0	20	20	0	0	20	20	20	0
		Subtotal	(10)	10	10	50	80	60	50	50	40	50	100	40
Bathymetry of Site	(9)	A	(10)	9	27	18	81	27	45	36	36	81	90	54
Exposure Considerations	(7)	A	(3)	21	21	21	21	14	21	21	21	21	21	21
		B	(3)	21	0	21	21	0	21	21	21	21	21	14
		C	(2)	0	0	14	14	0	0	0	14	14	14	14
		D	(2)	0	0	0	0	14	7	0	0	0	0	0
		Subtotal	(10)	42	21	56	56	28	49	42	56	56	56	49
Soil/Foundation Characteristics	(7)	A	(9)	0	0	42	21	21	0	21	42	42	21	21
		B	(1)	7	7	0	7	7	7	7	0	0	7	7
		Subtotal	(10)	7	7	42	28	28	7	28	42	42	28	28
Existing and Potential Land Use	(6)	A	(2)	0	0	0	0	0	0	0	0	0	0	6
		B	(2)	12	12	0	0	0	0	0	0	0	6	0
		C	(2)	0	0	6	6	12	6	0	12	12	6	0
		D	(2)	0	0	·0	12	0	6	0	6	12	12	0
		E	(2)	12	6	12	12	6	12	12	12	12	12	12
		Subtotal	(10)	24	18	18	30	18	24	12	30	36	36	18
Volume and Types of Dredged Material Available (see Table 4-7)	(4)	A	(10)	4	4	36	36	40	8	4	12	12	40	12
Proximity to Cultural Resources	(2)	A	(10)	10	10	10	10	2	10	20	2	2	2	2
Land Reuse Potential	(2)	A	(2)	2	2	0	4	4	2	2	4	4	4	2
		B	(3)	2	2	2	4	0	4	4	4	4	6	4
		C	(3)	0	0	0	6	0	2	0	6	6	2	0
		D	(2)	0	0	0	0	4	0	4	0	2	0	4
		Subtotal	(10)	4	4	2	14	8	8	10	14	16	12	10
Use of Site for Existing or Historical Spoil Disposal	(1)	A	(7)	0	0	0	0	0	0	7	0	4	4	0
		B	(3)	0	0	0	0	0	0	1	0	2	2	0
		Subtotal	(10)	0	0	0	0	0	0	8	0	6	6	0
Total Points	(480)			110	101	232	335	211	201	210	232	301	370	213
Ranking (Within Site Group)				2	1	2	1	3	4	5	3	2	1	4
Ranking (Overall, 35 Sites)				31	32	20(a)	7	22	26	23	20(b)	13	3	21

TABLE V-6

-SPECIFIC EVALUATION OF POTENTIAL SITES IN NEW YORK

NEW YORK SITES

4-5	4-6	4-7	4-8	4-9	P3-39	P3-43	P3-44 P4-5	P3-47	P4-4	P3-27 P5-8	6-3	6-4	6-5	7-1	7-3	P1-3	P1-4	P1-5	P1-6	P1-7	P2-6	P3-18	P3-24	P3-25	P3-26
20	20	20	20	20	20	20	20	20	20	20	20	10	0	20	20	10	10	20	20	20	20	10	20	20	20
20	10	10	0	10	20	20	20	10	20	20	20	20	20	10	20	10	20	20	20	20	20	20	20	20	20
20	0	0	10	10	10	10	10	10	10	10	10	20	10	0	10	10	0	10	10	10	20	20	10	10	10
20	10	10	20	10	10	10	10	20	10	10	0	0	0	20	0	10	10	0	10	10	20	10	10	10	10
20	0	0	0	20	20	20	10	10	20	20	20	20	20	20	20	10	20	20	20	20	20	20	20	20	20
100	40	40	50	70	80	80	70	70	80	80	70	70	50	70	70	50	60	70	80	80	80	80	80	80	80
90	54	18	27	18	90	90	81	0	0	90	63	18	9	9	90	45	90	90	63	90	90	0	27	72	54
21	21	14	14	14	21	21	21	21	21	21	21	21	21	0	21	21	21	21	21	21	21	21	21	21	21
21	14	14	21	14	21	21	21	21	21	21	21	21	21	0	21	21	21	21	21	21	21	21	21	21	21
14	14	0	14	14	14	14	14	14	14	21	14	14	14	14	14	14	14	14	14	14	14	14	0	14	14
0	0	7	0	0	7	7	0	7	7	0	0	0	0	0	0	0	14	0	7	0	7	0	7	7	7
56	49	35	49	42	63	63	56	63	63	56	56	56	56	14	56	56	70	56	62	56	63	56	49	63	63
21	21	21	21	0	21	21	21	0	42	42	0	21	0	42	42	63	63	63	21	42	42	63	42	42	42
7	7	7	7	7	7	0	0	7	0	0	7	7	7	0	0	0	7	7	0	0	0	0	0	0	0
28	28	28	28	7	28	21	21	7	42	42	7	28	7	42	42	63	70	70	21	42	42	63	42	42	42
0	6	0	0	0	0	12	6	6	6	6	0	0	0	12	0	6	6	6	6	6	0	6	6	0	6
6	0	0	0	6	0	0	6	6	0	0	12	0	0	0	0	6	6	6	6	6	12	6	12	12	0
6	0	6	0	6	6	12	12	12	6	6	12	12	6	12	6	12	6	12	6	12	12	6	12	12	12
12	0	0	0	12	6	12	6	0	6	6	12	12	12	0	12	0	0	0	0	6	0	6	0	0	6
12	12	6	6	6	12	12	0	12	6	6	12	12	6	12	12	6	6	12	6	0	6	6	12	0	12
36	18	12	6	30	24	36	30	36	24	24	48	36	24	36	30	30	24	36	24	30	30	30	42	24	36
40	12	8	12	12	36	36	36	12	12	8	4	12	4	0	12	12	40	36	36	40	36	8	12	12	12
2	2	10	10	10	20	10	10	10	20	20	20	20	2	20	2	20	20	20	20	2	20	20	0	0	2
4	2	2	2	2	2	4	0	2	0	2	4	4	4	2	4	2	2	0	2	2	2	0	2	2	2
6	4	2	2	2	6	6	6	6	4	4	4	4	4	4	4	4	4	6	4	0	4	4	4	4	4
2	0	0	0	2	2	0	2	0	2	2	6	6	6	6	6	0	2	0	2	2	0	2	0	0	2
0	4	0	0	0	4	0	2	0	4	4	2	4	4	0	4	2	2	4	2	2	2	4	0	0	0
12	10	4	4	6	14	10	10	8	10	12	16	10	18	12	18	8	10	10	10	6	8	10	6	6	8
4	0	0	0	0	0	0	4	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
2	0	0	0	0	0	0	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
6	0	0	0	0	0	0	7	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
370	213	155	161	195	355	346	321	206	257	256	284	250	170	203	320	284	384	388	329	346	369	267	258	305	303
1	4	8	7	6	4	5(b)	7	15	13	14	1	2	3	2	1	10	2	1	6	5(a)	3	11	12	8	9
3	21	30	29	27	5	6(b)	9	24	17	18	14(a)	19	28	25	10	14(b)	2	1	8	6(a)	4	15	16	11	12

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TABLE V-7

SUMMARY OF SECONDARY SITING ANALYSIS
IN NEW YORK

Site Group	No. Sites	Average Pts. Scored	% Score	Range of Pts. Scored	Total Pts. Possible
1. Shallow Water Sites	2	106 (120)	22% (20%)	101-110 (117-123)	480 (590)
2. Treatment Plants	4	245 (292)	51% (49%)	201-335 (235-409)	480 (590)
3. Power Plants	0	- (-)	- (-)	- (-)	- (-)
4. Corps. Nav. Proj.	8	230 (268)	48% (45%)	155-370 (159-470)	480 (590)
5. Ind. Discharges	0	- (-)	- (-)	- (-)	- (-)
6. Pet. Facilities	3	235 (279)	49% (47%)	170-284 (220-339)	480 (590)
7. Sand & Gravel	2	262 (288)	55% (49%)	203-320 (210-365)	480 (590)
8. Public Sites*	16	311 (356)	65% (60%)	206-388 (242-429)	480 (590)
Total	35 (35)				480 (590)

( ) Criteria Points Scored Under Second Set of Weighting Factors
* Public Sites Previously Analyzed in Interim Report

TABLE V-8

TOP TEN RANKING SITES IN NEW YORK

Rank	Score %	Site No.	Name of Site	Waterway	Quad Map No.	Map
1	81	P1-5	Fort Totten	Little Neck Bay	1	A
2	80	P1-4	U.S. Merchant Marine Ac.	Little Neck Bay	1	A
3	77	4-5	Dike	Flushing Bay	1	A
4	77	P2-6	New York State Merchant Marine Ac.	East River	1	A
5	74	P3-39	Little Bay Park	East River	1	A
6(a)	72	P1-7	U.S. Military Reservation	Long Is. Sound	1	A
(b)	72	P3-43	Ferry Point Park	East River	1	A
7	70	2-12	Tallman Island*	East River	1	A
8	69	P1-6	U.S. Naval Reservation	East River	1	A
9	67	P4-5 P3-44	Pelham Bay Park Pelham Bay Park	East Chester Bay	1	A
10	67	7-3	Colonial Sand & Stone	Hempstead H.	1	A

* Municipal Wastewater Treatment Plant

CRITERIA	Weighting Factors (1)	(2)	1-3	1-4	1-5	1-7	1-8	1-11	1-12	1-13	1-14	1-16	1-17	1-18
Ecological	10	10	50	40	60	20	20	0	0	10	20	0	0	0
Bathymetry	9	10	30	30	70	80	40	100	50	40	40	100	40	100
Exposure	7	7	42	42	21	0	0	14	21	35	35	35	42	42
Soils	7	2	2	2	20	2	2	2	2	2	2	2	2	2
Land Use	6	7	42	35	21	28	28	21	21	21	28	28	21	28
Vol. of DM	4	9	18	18	36	27	27	27	27	72	72	72	72	9
Cultural	2	2	10	10	20	10	10	10	2	2	2	2	10	10
Reuse	2	7	28	49	7	28	21	28	35	7	7	28	14	14
Hist. Disp.	1	5	30	30	0	0	0	0	20	20	0	0	0	0
Total (1)	480		194	184	270	153	106	159	119	146	178	198	149	181
Total (2)		590	252	256	255	195	148	202	178	209	206	267	201	205
Percent of Total (1)			40	38	56	32	22	33	25	30	37	41	31	38
Percent of Total (2)			43	43	43	33	25	34	30	35	35	45	34	35
Ranking (1)			26	28	5(b)	37	41	34	40	39	30	23	38	29
Ranking (2)			25	23	24	37	41	35	40	31(a)	33	20	36	34

TABLE V-9
WEIGHTING FACTOR SENSITIVITY ANALYSIS FOR CONNECTICUT SITES

1-18	2-16	2-18	2-20	2-22	2-24	P3-69 2-25	2-26	P3-71 2-27	2-29	2-30
0	70	50	60	20	50	60	70	60	70	50
100	10	30	10	40	30	100	40	80	30	10
42	49	42	49	56	21	63	49	56	56	56
2	2	14	2	2	8	6	6	6	8	2
28	28	7	42	42	35	28	63	35	42	42
9	9	18	36	45	90	90	90	90	54	54
10	10	20	20	10	10	20	20	20	20	20
14	63	28	42	49	42	56	63	63	49	49
0	25	0	25	30	0	0	25	0	25	25
181	196	210	160	187	218	334	313	317	280	221
205	266	209	286	294	286	423	426	410	355	309
38	41	44	33	39	45	69	65	66	58	46
35	45	35	48	49	48	72	72	69	60	52
29	24	20	32	27	16(b)	1(c)	3	2(b)	4	15
34	21(a)	31(b)	16(a)	15	16(b)	2(c)	1	3(b)	7	13

3-7	3-9	3-13	3-14	4-10	4-13	4-14	4-15	4-17[a]	4-17[b]	4-18	4-19	4-20	4-21	5-4
30	80	50	20	30	50	30	10	40	30	30	50	10	20	50
60	10	20	20	90	70	90	40	100	100	50	100	40	50	40
42	49	42	28	42	14	42	21	21	42	42	21	28	49	56
8	2	6	20	12	6	6	2	8	12	2	8	8	12	8
28	21	49	42	28	21	49	7	35	14	7	42	14	21	49
9	27	90	27	18	36	36	27	90	45	27	36	72	18	36
20	10	20	20	10	20	2	2	2	2	10	10	10	10	10
21	42	56	42	14	21	70	7	49	21	14	7	7	28	63
25	30	30	0	0	30	15	0	0	0	0	0	0	0	30
213	203	255	216	241	214	257	96	265	244	156	253	158	200	262
243	271	363	219	244	268	340	116	345	266	182	274	189	208	342
44	42	53	45	50	45	54	20	55	51	33	53	33	42	55
41	46	62	37	41	45	58	19	58	45	31	46	32	35	58
19	21	10(b)	17	14	18	9	42	6	12	35	11	35	22	7
27	18	6	28	26	19	10	42	8	21(b)	39	17	38	32	9

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SIS FOR CONNECTICUT SITES

3-14	4-10	4-13	4-14	4-15	4-17[a]	4-17[b]	4-18	4-19	4-20	4-21	5-4	P3-69 5-8	6-14	6-17 6-16	6-18	6-20	P1-9	P1-10	P3-50	P3-58	P3-69	P3-72 P3-71
20	30	50	30	10	40	30	30	50	10	20	50	60	40	40	70	50	60	70	60	70	60	60
20	90	70	90	40	100	100	50	100	40	50	40	100	20	30	10	30	10	40	10	10	100	80
28	42	14	42	21	21	42	42	21	28	49	56	63	35	49	49	56	63	63	42	35	63	56
20	12	6	6	2	8	12	2	8	8	12	8	6	8	8	6	2	0	0	0	0	6	6
42	28	21	49	7	35	14	7	42	14	21	49	28	35	35	49	49	28	35	35	42	28	35
27	18	36	36	27	90	45	27	36	72	18	36	90	27	90	90	54	54	54	9	18	90	90
20	10	20	2	2	2	2	10	10	10	10	10	20	10	20	20	20	20	20	2	10	20	20
42	14	21	70	7	49	21	14	7	7	28	63	56	56	63	49	56	63	42	56	28	56	63
0	0	30	15	0	0	0	0	0	0	0	30	0	30	30	25	0	0	0	0	0	0	0
216	241	214	257	96	265	244	156	253	158	200	262	334	195	258	270	242	218	255	163	176	334	317
219	244	268	340	116	345	266	182	274	189	208	342	423	261	365	368	317	298	324	214	213	423	410
45	50	45	54	20	55	51	33	53	33	42	55	69	41	54	56	50	45	53	34	37	69	66
37	41	45	58	19	58	45	31	46	32	35	58	72	44	62	62	54	51	55	36	36	72	69
(b) 17	14	18	9	42	6	12	35	11	35	22	7	1(b)	25	8	5(a)	13	16(a)	10(a)	33	31	1(a)	2(a)
28	26	19	10	42	8	21(b)	39	17	38	32	9	2(b)	22	5	4	12	14	11	29	30	2(a)	3(a)

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WEIGHTING FACTOR SENSI

CRITERIA	Weighting Factors (1)	(2)	1-1	1-2	2-11	2-12	2-13	2-14	PS-2 4-3	4-4(a)	4-4(b)	4-5	4-6	4-7	4-8	4-9
Ecological	10	10	10	10	50	80	60	50	50	40	50	100	40	40	50	70
Bathymetry	9	10	10	30	20	90	30	50	40	40	90	100	60	20	30	20
Exposure	7	7	42	21	56	56	28	49	42	56	56	56	49	35	49	42
Soils	7	2	2	2	12	8	8	2	8	12	12	8	8	8	8	2
Land Use	6	7	28	21	21	35	21	28	14	35	42	42	21	14	7	35
Vol. of DM	4	9	9	9	81	81	90	18	9	27	27	90	27	18	27	27
Cultural	2	2	10	10	10	10	2	10	20	2	2	2	2	10	10	10
Reuse	2	7	14	14	7	49	28	28	35	49	56	42	35	14	14	21
Hist. Disp.	1	5	0	0	0	0	0	0	40	0	30	30	0	0	0	0
Total (1)	480		110	101	232	335	211	201	210	232	301	370	213	155	161	195
Total (2)		590	123	117	257	409	267	235	258	261	335	470	242	159	195	227
Percent of Total (1)			23	21	48	69	44	42	44	48	63	77	44	32	34	41
Percent of Total (2)			21	20	44	69	45	40	44	44	57	79	41	27	33	38
Ranking (1)			31	32	20(a)	7	22	26	23	20(b)	13	3	21	30	29	27
Ranking (2)			33	34	25	8	21	27	24	23	15	1	26(b)	32	31	28

TABLE V-10
OR SENSITIVITY ANALYSIS FOR NEW YORK SITES

4-8	4-9	6-3	6-4	6-5	7-1	7-3	P1-3	P1-4	P1-5	P1-6	P1-7	P2-6	P3-18	P3-24	P3-25	P3-26	P-3-39	P3-43	P3-44 P4-5	P3-47	P4-4	P3-27 P5-8
50	70	70	70	50	70	70	50	60	70	80	80	80	80	80	80	80	80	80	70	70	80	80
30	20	70	20	10	10	100	50	100	100	70	100	100	0	30	80	60	100	100	90	0	0	100
49	42	56	56	56	14	56	56	70	56	63	56	63	56	49	63	63	63	63	56	63	63	56
8	2	2	8	2	12	12	18	20	20	6	12	12	18	12	12	12	8	6	6	2	12	12
7	35	56	42	28	42	35	35	28	42	28	35	35	35	49	28	42	28	42	35	42	28	28
27	27	9	27	9	0	27	27	90	81	81	90	81	18	27	27	27	81	81	81	27	27	18
10	10	20	20	2	20	2	20	20	20	20	2	20	20	0	0	2	20	10	10	10	20	20
14	21	56	35	63	42	63	28	35	35	35	21	28	35	21	21	28	49	35	35	28	35	42
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	30	0	0	35	0	30	25
161	195	284	250	170	203	320	284	384	388	329	346	369	267	258	305	303	355	346	321	206	257	256
195	227	339	278	220	210	365	284	423	424	383	396	419	262	268	317	344	429	417	418	242	295	381
34	41	59	52	35	42	67	59	80	81	69	72	77	56	54	64	63	74	72	67	43	54	53
33	38	57	47	37	36	62	48	72	72	65	67	71	44	45	54	58	73	71	71	41	50	65
29	27	14(a)	19	28	25	10	14(b)	2	1	8	6(a)	4	15	16	11	12	5	6(b)	9	24	17	18
31	28	14	19	29	30	12	18	4	3	10	9	5	22	20	16	13	2	7	6	26(a)	17	11

2

TABLE V-11

TOP TEN SITE GROUPS IN CONNECTICUT

Group No.	Ranking (1)	Ranking (2)	Site No.	Name of Site	Figure No.
1	1(a)	2(a)	P3-69	Bayview Park	5
	(b)	(b)	5-8	Sargent & Co.	
	(c)	(c)	2-25	New Haven Blvd.*	
	3	1	2-26	New Haven-East St.*	
2	2(a)	3(a)	P3-71,72	East Shore & Nathan Hale Parks	5
	(b)	(b)	2-27	New Haven-East Side*	
	10(b)	6	3-13	English - United Illuminating	
3	9	10	4-14	Breakwaters-Bridgeport H.	6
	7	9	5-4	Remington Electric	
4	10(a)	11	P1-10	U.S. Coast Guard Academy	7
	4	7	2-29	Riverside Plant*	
5	5(a)	4	6-18	Oil Terminals - Atlantic Richfield Exxon Getty Oil Co. Gulf Oil Corp. New Haven Terminal	5
6	5(b)	24	1-5	Kelsey Island	8
7	6	8	4-17a	Breakwater, New Haven H.	5
	16(b)	16(b)	2-24	West Haven*	
8	8	5	6-16	Connecticut Refining Co.	5
			6-17	Elm City Plant No. 3	

* Municipal Wastewater Treatment Plant

Figures V-10 thru V-13. The listing of the revised top site groups in New York are shown on Table V-12 and depicted on Figures V-14 thru V-18.

Discussion of Findings

As mentioned under the Interim Report discussion, none of the sites were coordinated with local interests such as municipal officials or in-depth discussions with State agencies. The intent of the Interim Report and the addendum to the Interim Report was to find out where containment facilities might be viable using available information and relative screening criteria. The consultant who prepared both reports did that. He used numerous available coastal resources maps for both Connecticut and New York as well as various county maps, planning board maps, published reports and some discussions with State, Federal, and local officials. It was not the intent of the two reports to get approval on each individual site from the respective agencies or local interests. This would have necessitated an extensive public participation program which was not budgeted. It was hoped that any truly environmentally sensitive areas would have been well documented (such as the Long Wharf area in New Haven) and would be reason for elimination in the matrix table. What resulted was having a minimal amount of points assigned for an individual aspect (such as the oyster beds and bird feeding areas of the mud flat in New Haven Harbor). However when all other aspects were considered, as shown on the matrix, the New Haven site is viable based upon the screening as devised by the consultant.

Letters were sent to New York State officials asking for comment on their top site groups. These responses were all similar. None of the sites are viable, mainly because of the presence of shellfish stocks and tidal wetlands. One letter even mentioned that if a site in New York waters appeared feasible, that group would do everything possible to prevent its consideration.

Coordination with Connecticut officials was much more positive. While shellfish stocks are indeed very important, it was acknowledged that not every foot of Connecticut coastline was ecologically significant. It was agreed however, that some shortcomings of the evaluation proceedure did indeed exist. At these coordination sessions, the New Haven shoreline considered in the 2 reports was removed from future consideration, along with the Bridgeport site which happened to be the city beach. Somehow, the evaluation procedure failed to identify that site as a beach area. It was further agreed that the best approach to take, regarding facility siting, was to get the sites recommended by local interests first rather than theoretically finding where sites might be available based upon maps which might be inaccurate. In addition, strong local support for a project may be enough to offset some minor ecological losses.

The same general approach was followed for future New York sites. If strong local support was evident, sites may be considered. However none of the sites previously considered would be viable or sufficient so that more in-depth studies could not be recommended.

PUBLICLY RECOMMENDED SITES

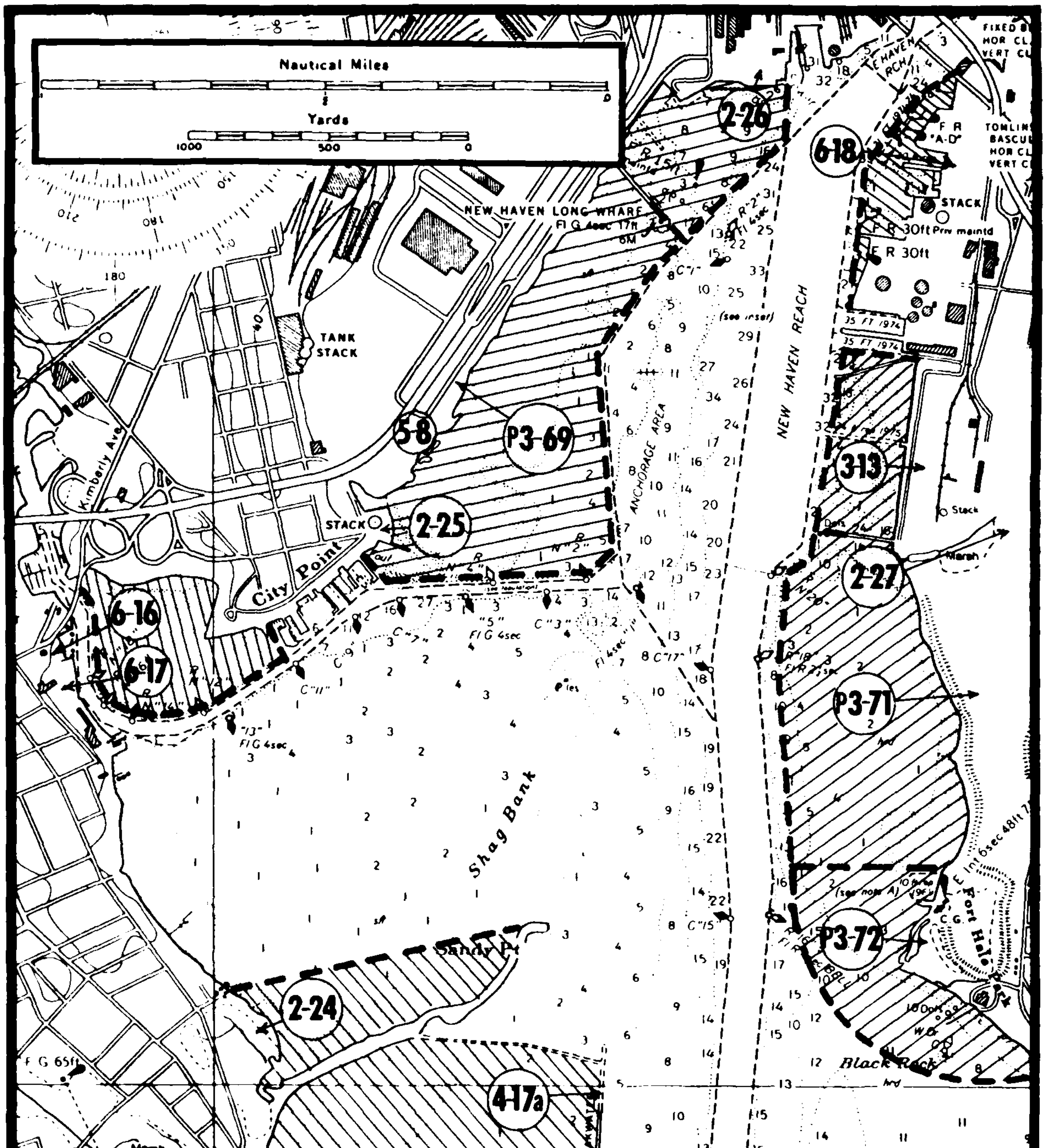
As a result of the discussions with local interests and State officials after preparation of the various reports to date a different approach to site screening was followed. This approach was to actively involve the general public in the plan formulation - site selection process. Initially, letters were sent to all Connecticut coastal communities requesting sites to be recommended. The response to that request was poor. Relatively few sites of any significance were recommended.

Two sites of merit which were suggested as island containment facilities were Black Ledge off of Groton, Connecticut by the city of Groton Conservation Commission and a shoreline extension project off of either Hammonasset Beach or Clinton Town Beach by the Yorkhaven Marina. Copies of both these letters are also in the public coordination section. The Groton Conservation Commssion has been in recent history a strong advocate of containment islands. This office has received letters from them since 1977 recommending a containment facility at Black Ledge.

Several other letters dealing with the Clinton proposal came in shortly after the initial coordination effort. Presentations were made to representatives of the Groton Conservation Commission and Waterfront Association, and to the Harbor Study Commission for Clinton. Several other sites were offered for consideration by various other groups; Fayerweather Island, Bridgeport; Yellow Mill Channel, Bridgeport; Two Tree Island, Westbrook; several "holes" in the bottom of Long Island Sound in close proximity to shoreline which had previously been used for excavation of fill material during the construction of the Connecticut Turnpike - Sherwood Island, Westport - Morris Cove and Prospect Beach - New Haven. As has been stated previously, the New England Division has never built a containment facility. Very few in fact have even been considered. Little data in the terms of costs of environmental studies, socio-economic studies, engineering aspects etc. were available. It was decided to advance the Black Ledge site and the Clinton site into the detailed planning stage so that we would have a better understanding of costs and efforts required to complete detailed analysis for each site (formerly equivalent to stage III studies). One of the major reasons was due to the fact that there were no in-house capabilities for the environmental services required to determine potential impacts at the Clinton and Black Ledge sites.

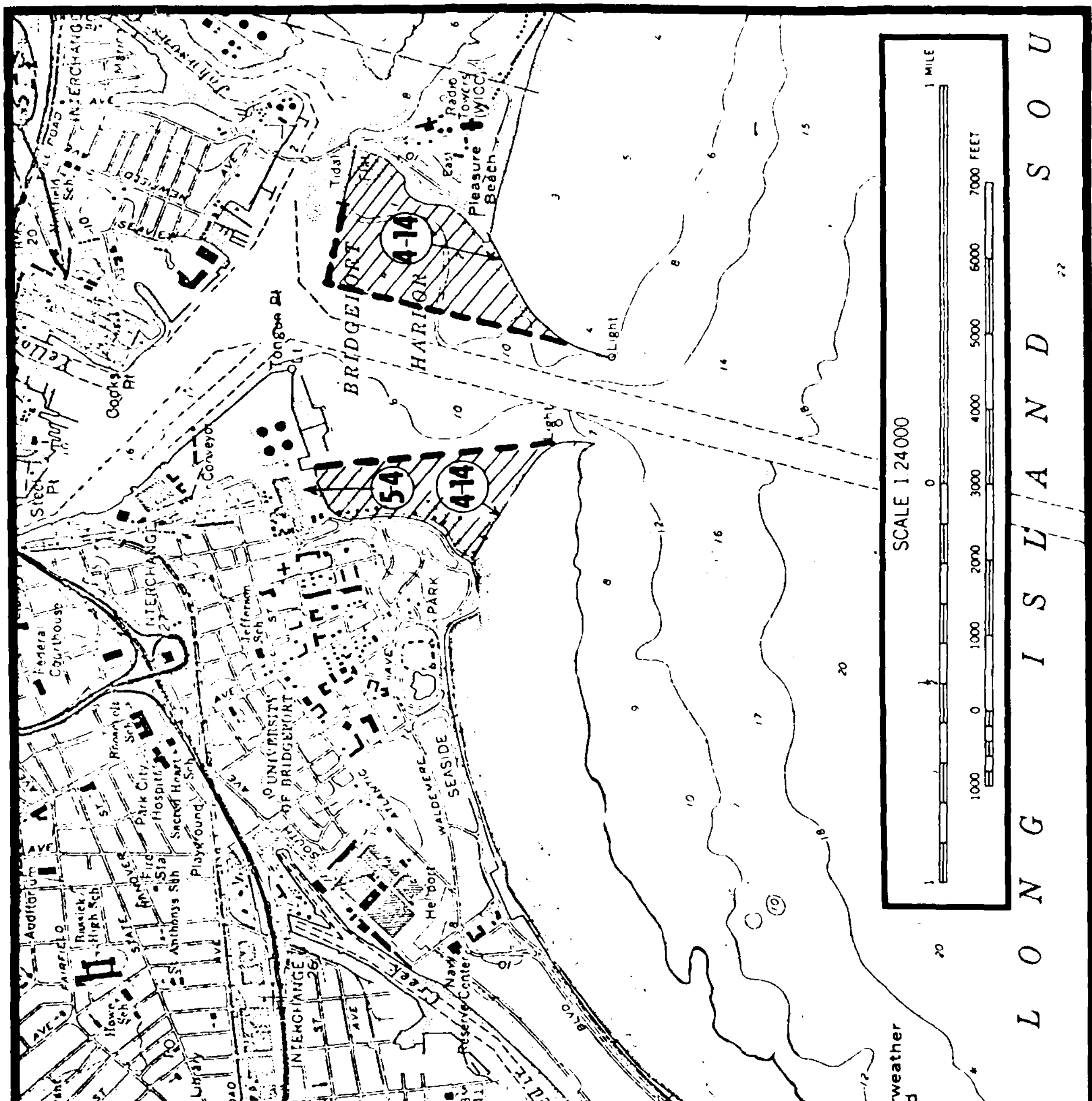
While the office was seeking a consultant for the environmental work in early 1981, a series of workshops for May 1981 was being planned. The workshops are fully described in the coordination section. A public workshop brochure was prepared and it is also included in that section.

The workshops were held, attended by over 200, and were generally well received by the attendees and the media. Numerous discussions were held after the sessions with representatives of towns, marina groups,



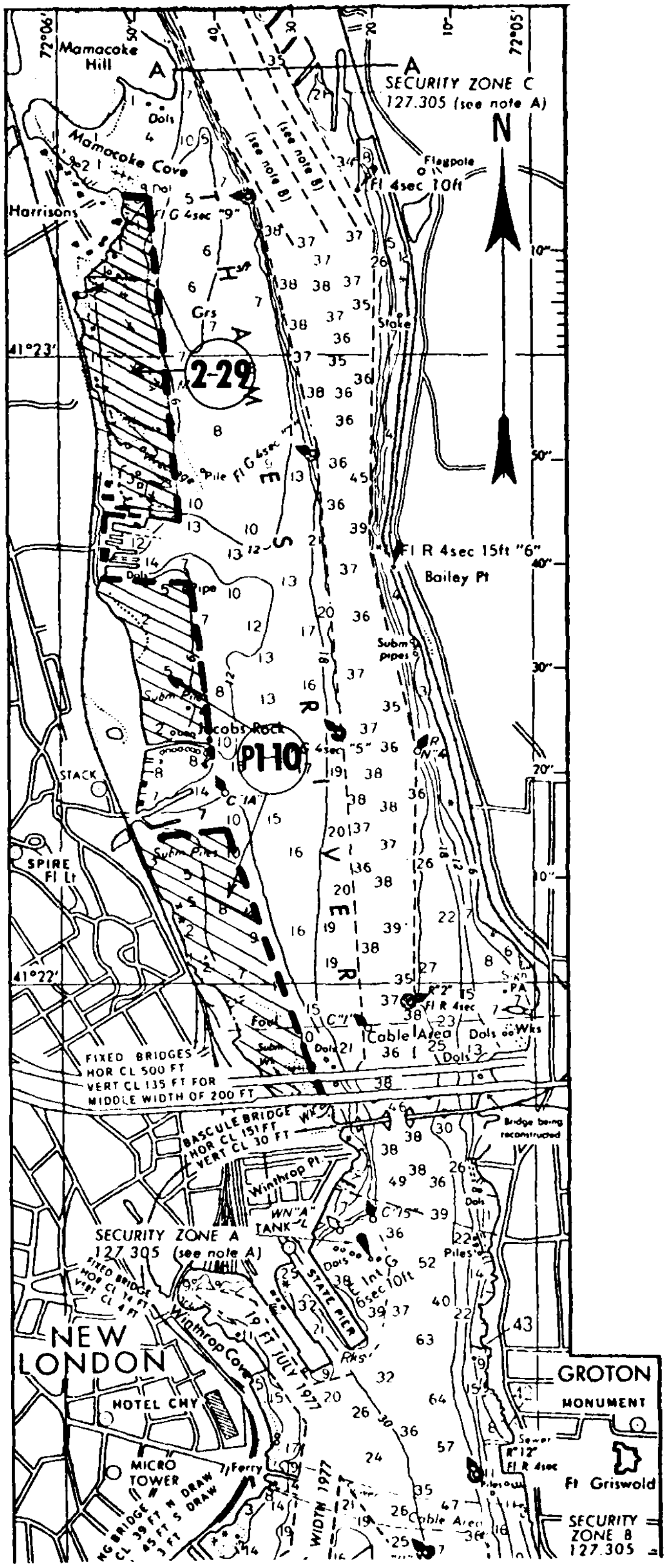
LOCATION OF POTENTIAL CONTAINMENT SITES IN NEW HAVEN HARBOR

Figure V-10



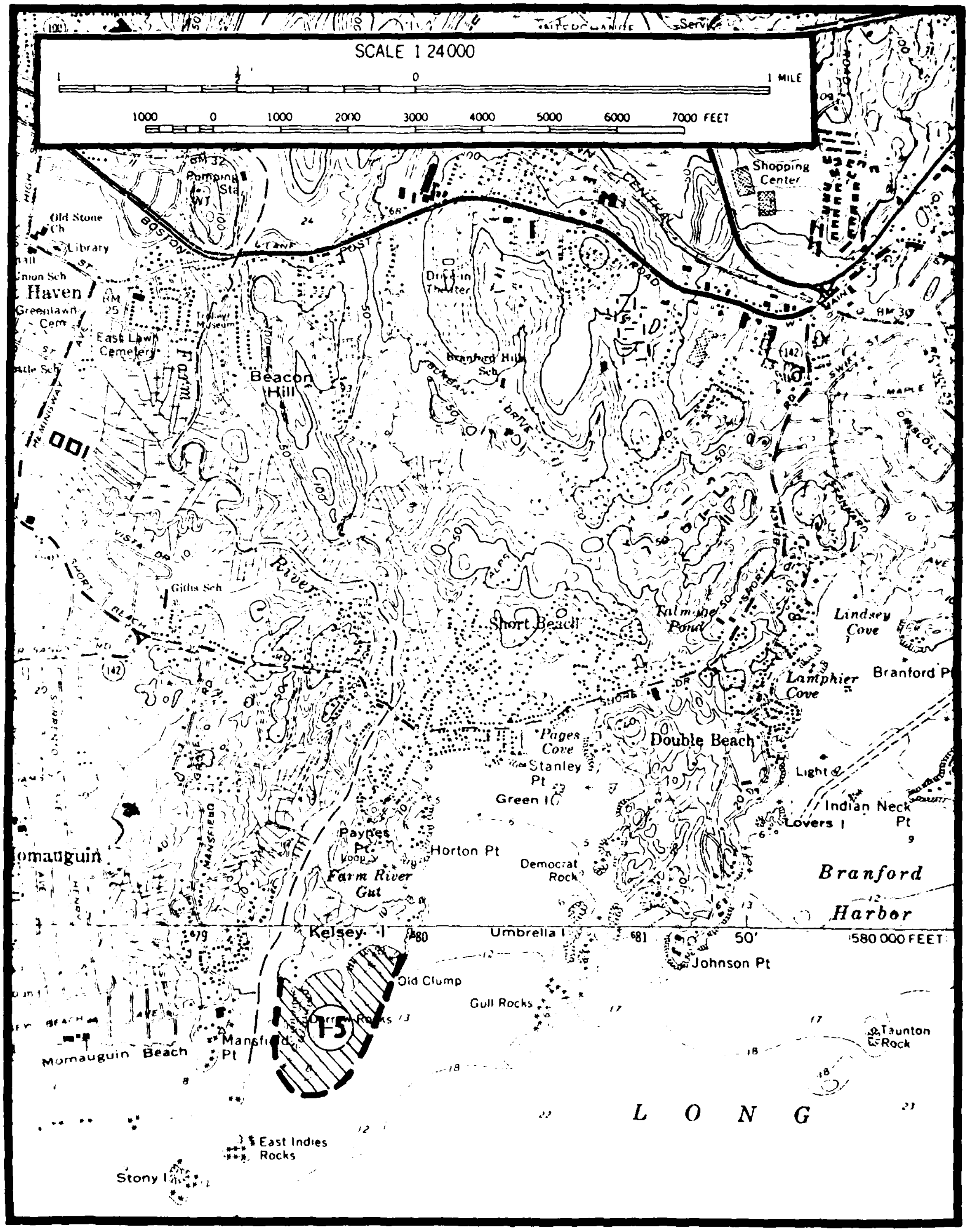
LOCATION OF POTENTIAL CONTAINMENT SITES AT BRIDGEPORT HARBOR

Figure V-11



LOCATION OF POTENTIAL CONTAINMENT SITES IN NEW LONDON

Figure V-12



LOCATION OF POTENTIAL CONTAINMENT SITE NEAR BRANFORD HARBOR

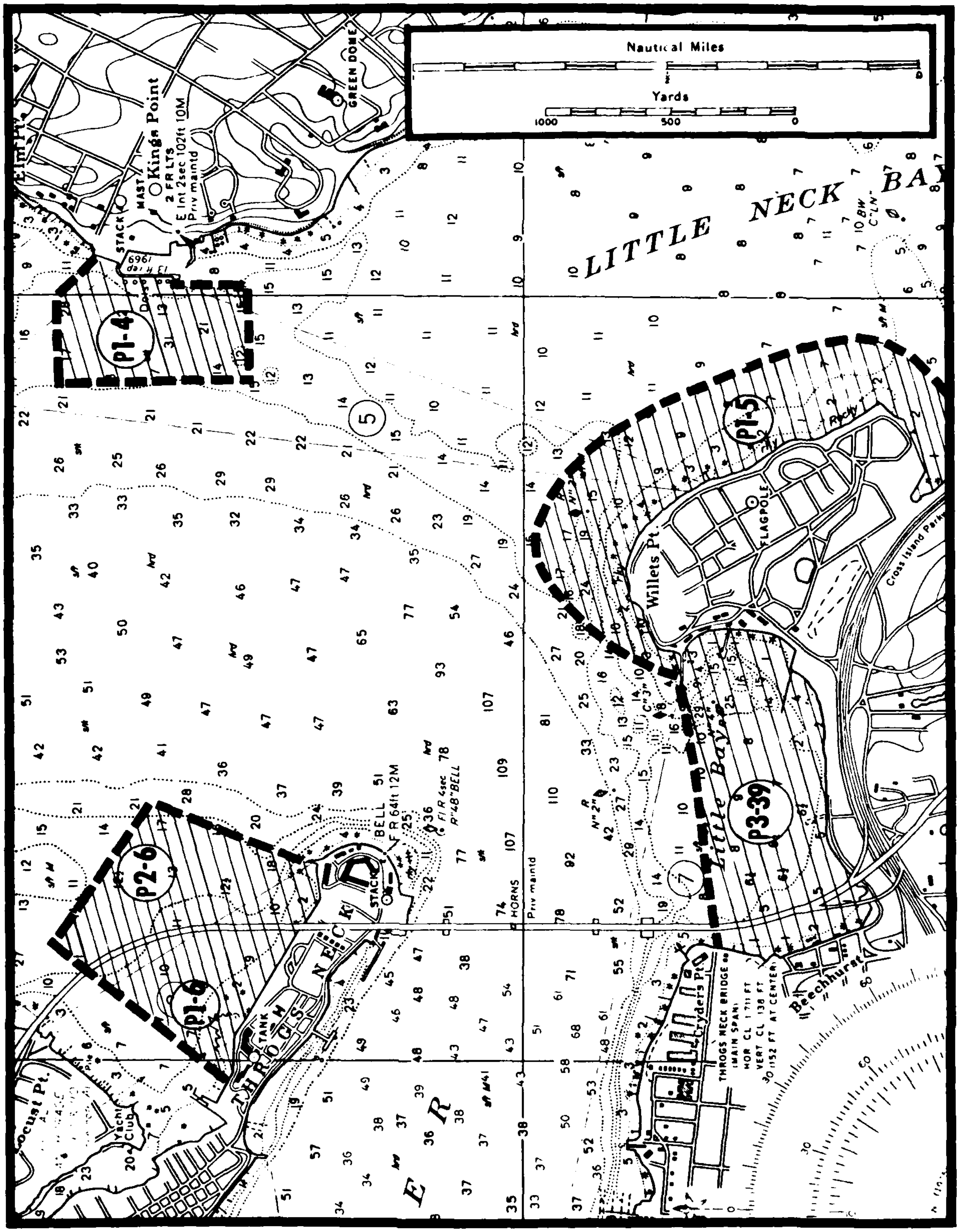
Figure V-13

TABLE V-12

TOP SITE GROUPS IN NEW YORK

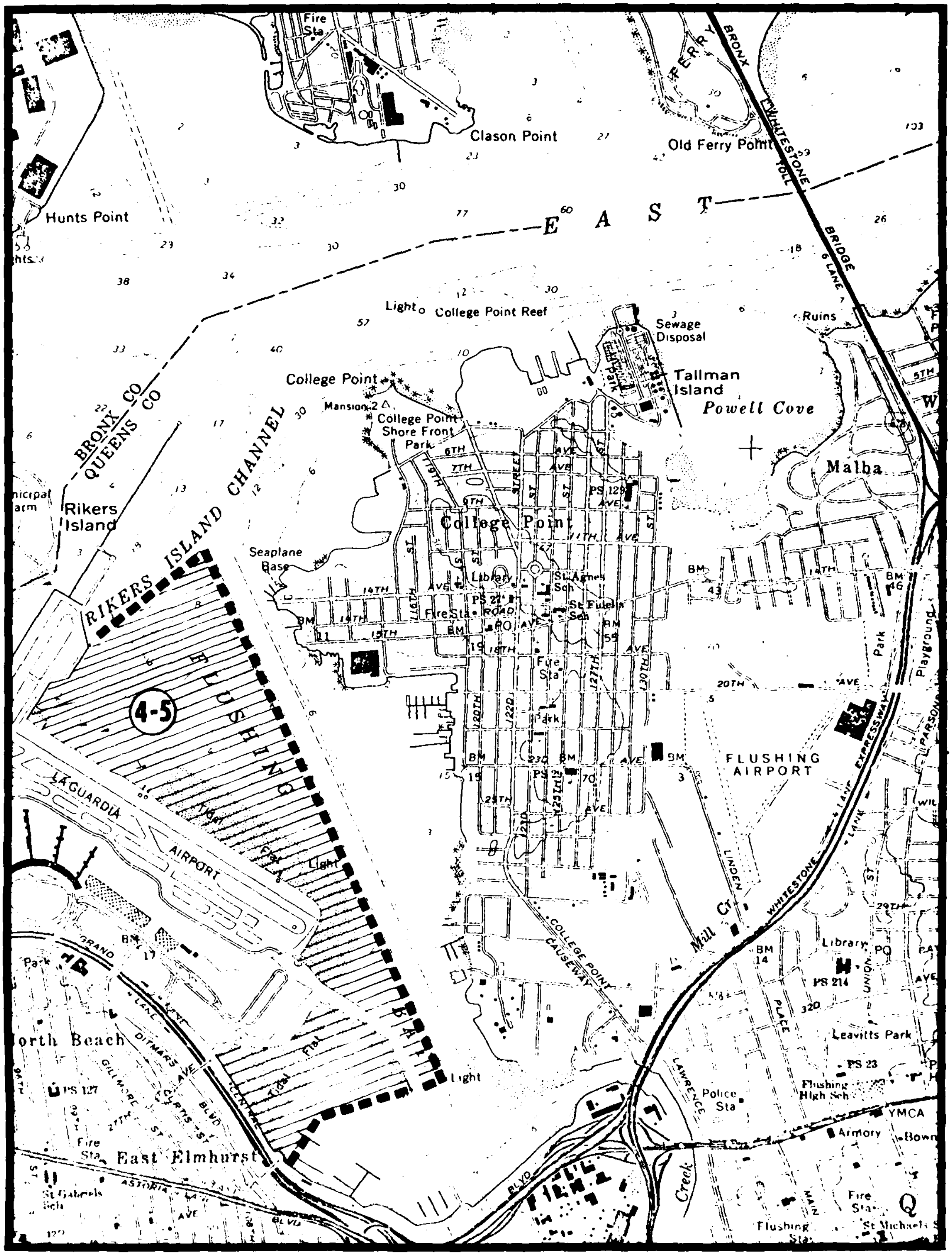
Group No.	Ranking (1)	Ranking (2)	Site No.	Name of Site	Figure
1	1 5	3 2	P1-5 P3-39	Fort Totten Little Bay Park	9
2	2	4	P1-4	U.S. Merchant Marine Ac.	9
3	3	1	4-5	Dike, Flushing Bay	10
4	4 8	5 10	P2-6 P1-6	New York State Merchant Marine Ac. U.S. Naval Reservation	9
5	6(a)	9	P1-7	U.S. Military Reservation	11
6	6(b)	7	P3-43	Ferry Point Park	12
7	7	8	2-12	Tallman Island*	12
8	9	6	P4-5 P3-44	Pelham Bay Park Pelham Bay Park	11
9	10	12	7-3	Colonial Sand & Stone	13

* Municipal Wastewater Treatment Plant



LOCATION OF POTENTIAL SITES AT THROGS NECK

Figure V-14

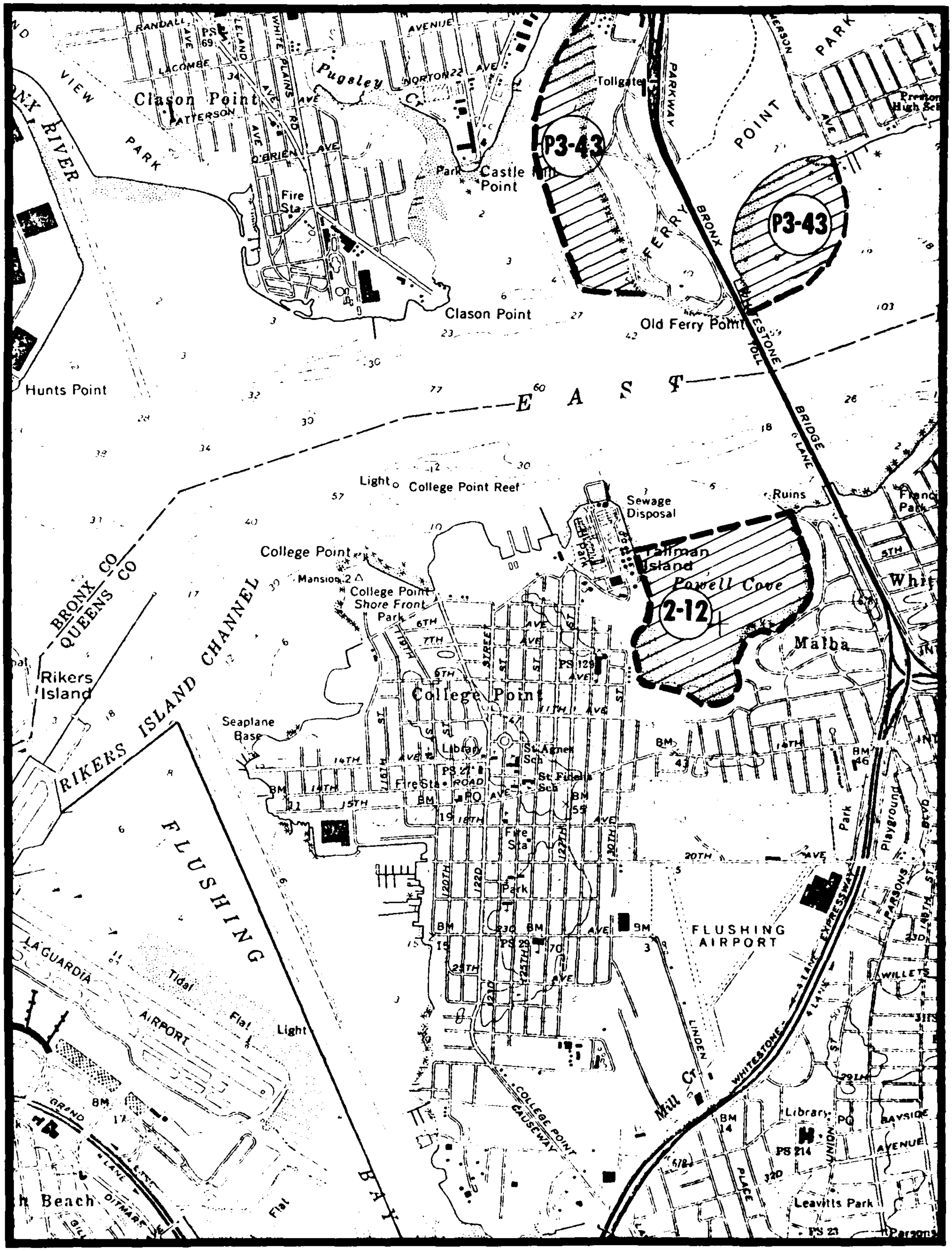


LOCATION OF POTENTIAL SITE AT FLUSHING BAY

Figure V-15

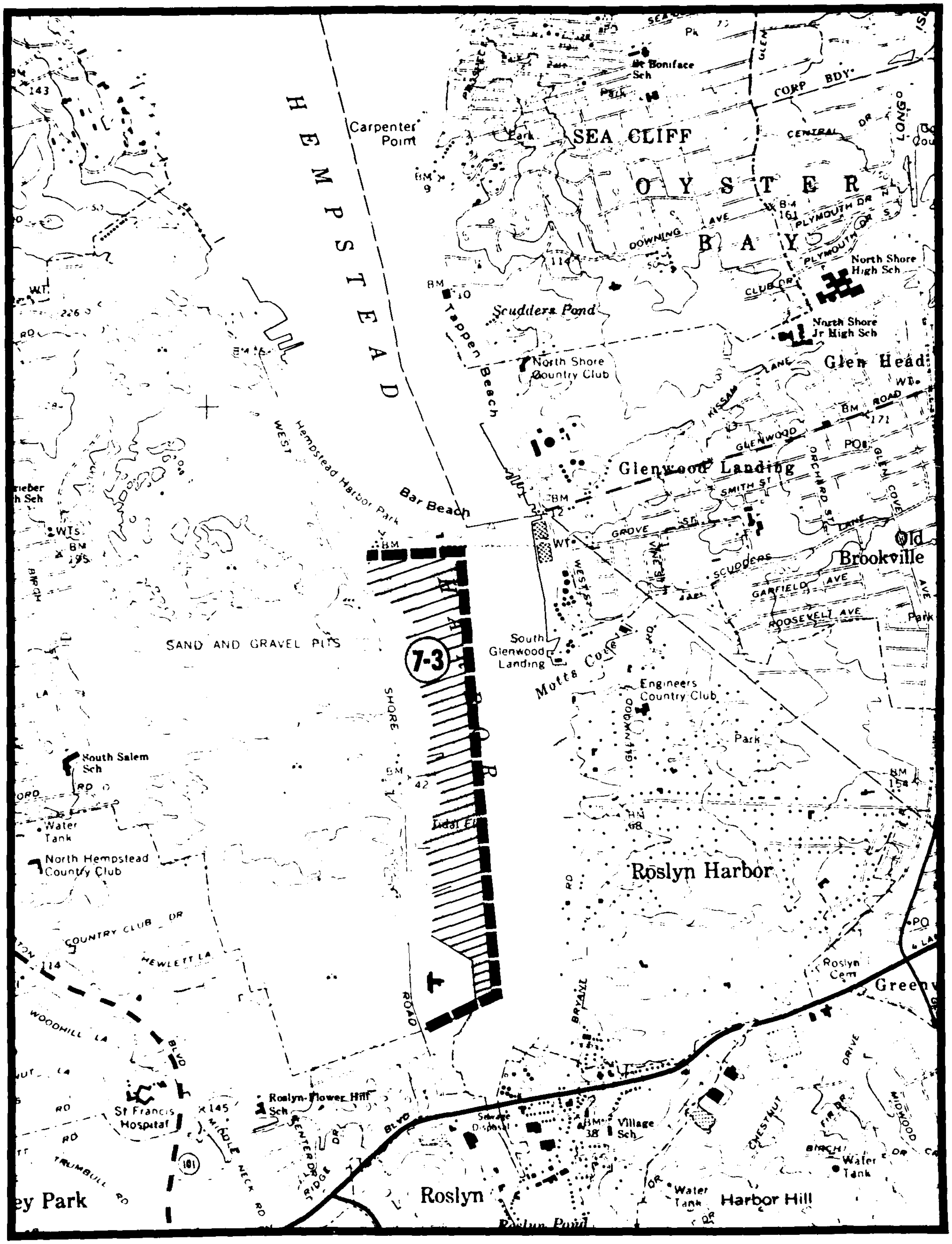
LOCATION OF POTENTIAL SITES NEAR PELAHM BAY PARK

Figure V-16



LOCATION OF POTENTIAL SITES IN UPPER EAST RIVER

Figure V-17



LOCATION OF POTENTIAL SITE IN HEMPSTEAD HARBOR

Figure

trade organizations, etc. While many potential sites were named and initially investigated few turned out to be good potential sites. Possible sites to consider were in Mamaroneck, New York; Gold Star Bridge area in New London, Fairfield, Bridgeport, Housatonic River, Mianus River, in Milford Harbor, Connecticut. Each of these sites was investigated and determined to be initially feasible for consideration. All of these sites resulted from the workshop sessions. The sessions are summarized in the coordination section.

In August 1981, an institutional analysis request was sent to about 100 local officials and interest groups asking for additional comments on the containment study. While only 1/3 of the requests were returned there were some additional sites recommended.

Generally, the responding officials favored the containment concept. As above, this item is fully discussed under public coordination. Sites which came out of this survey which appear to be good potential candidate sites include Penfield Reef in Fairfield, an area in West Haven, a formerly used low lying disposal area in Branford, a site in Westport, Connecticut and a site in Flushing Bay , New York.

The results of the institutional analysis are shown on Table V-16.

In addition to the above sites which were arrived at through a strong public participation program, records of previous public hearings on dredging activities at Long Island Sound were reviewed. In some of the testimony alternative disposal sites were mentioned. Many of these sites had previously been investigated either in the McAleer/Reconnassiance Effort or in the Interim Report. However there were enough new sites suggested so that a small island/shoal screening report was contracted with a Long Island Sound local interest group. No significant new sites were recommended by that report.

ISLAND SHOAL SCREENING REPORT

Nine areas were evaluated based upon the following criteria: biological productivity, shellfish concentrations, finfish concentrations, size of potential containment facility, existing land use, distance to dredging activities and navigation hazards. The consultant for this report was required to use available information such as previously prepared reports and contact with appropriate individuals or interests which would have knowledge of the area(s) in question. The findings of each site are summarized in the following paragraphs.

Captain Harbor, Greenwich - While the site appears to be technically feasible, there would apparently be some opposition from coastal residents. It is however the best site evaluated in Western Long Island Sound.

Norwalk Islands, Norwalk - Biological productivity, high concentrations of shellfish and finish, along with the recreational land use patterns prompt rejection of this site from further consideration.

Thimble Islands, Branford - While technicially feasible, public opposition to this site was strong, and the area has a high degree of biological productivity and concentrations of shellfish and finfish.

Falkner/Goose Island, Guilford - This site was determined to be feasible and warrents further investigation. Items which should be addressed in more detail and an evalation of the loss of bottom habitat covered by the facility against the new habitat created, - the effects on the term population; and the overall feasibility as the island is located in exposed waters, 2 1/2 miles from shore.

Six Mile Reef, Clinton - This site was rejected because of high biological productivity and the potential for creating navigation hazards.

Duck Island Roads, Clinton - This study warrants further investigation. Future studies should address the net environmental impact, effect on shreline erosion, and design considerations.

Bartlett Reef, Waterford - High biological productivity, and the potential for creating navigation hazards were the main reasons for elimination of this site, additionally its in a area known for its strong currents.

Stratford Shoals, Stratford - This site is also feasible for further study. Environmental studies and engineering design are big items which need evaluation.

Menunketesuck Island, Westbrook - Size limitations and disruption of habitat presently used by shorebirds even factors in ruling out this site. It is also adjacent to municipal beaches and areas of high biological productivty.

SUMMARY OF PLAN FORMULATION EFFORTS

Clinton

The initial discussion on the Clinton site involved a shoreline extension project. The site adjoining the town beach was ruled out due to limited volume and location (immediately adjacent to the existing Federal channel). It would also have eliminated significant portions of the beach. The other site, near Hammonassett Beach (a portion of which is located in Madison) was selected for evaluation. It became apparent upon detailed investigations that a marsh creation project was more feasible than the true containment project. The dredged material which would come out of Clinton Harbor is all relatively clean material with some organics, oils and grease. It is one of the cleanest harbors in Connecticut and a

marsh project would be far superior because of the absence of heavy metals and other chemicals of concern. It would be easier to build, operate and maintain, and cost significantly less. It would have to be built in the normal tidal range because it would be a marsh. A plan view of this site with its retaining dikes is shown on figures V-19.

Immediately adjacent to the proposed site is a significant tidal wetland. With careful planning and design the marsh creation project would blend very favorably with the existing site. All elevations at this marsh creation site would appear natural.

Retaining dikes would be built to help protect the marsh. Their final elevation would be +6 mean low water, or an elevation which corresponds to the various naturally ocurring rock formations along the shoreline at the site where the facility would tie into high ground. In addition there are numerous rocks located in the water which form a relatively straight alignment (out towards Wheeler Rock). They, too, are in the +4 to +6 mean low water range and could easily blend in as part of the retaining dike system.

As the dredged material is deposited behind the retaining dikes, the elevations of the "mounds" would be carefully observed. The high points would be at approximately +7 mean low water while the low points would be submerged at mean low water. This would be very similar in appearance to the existing marsh.

The marsh creation project would not interfere with the existing marsh, reduce its present size, nor create any undue stress upon it. In fact, it would help protect portions (western most area) of it which are presently subject to slight erosion.

A full explanation of the environmental findings at the Clinton site is included in the Environmental Impact Report. By building a marsh creation project at this site there would be an overall significant ecological enhancement. Also included in this impact report is a discussion on the suggested development of the site. When filled to capacity the planned site would encompass an area of about 100 acres. It would have about 4800 linear feet of riprapped faced retaining dike with a weir structure approximately 50 feet wide. (This portion has not yet been designed; only assumed based upon best available information.) The facility would hold about 1 MCY of material, all from Clinton. This is a constraint imposed upon the project since a marsh project requires filling by a hydraulic dredge. No other harbors are within a 4 mile radius of the site. The most likely distance a hydraulic dredge would pump that could be used in Clinton Harbor would be approximately 1 1/2 mile.

When filled to capacity according to the planned sequence of the EIR, about 55 acres of Spartina alterniflora marsh would be created on fine gravel materials at elevations between 4 and 5 feet mean low water. Thirteen acres of S. alterniflora would be developed in the predominantly

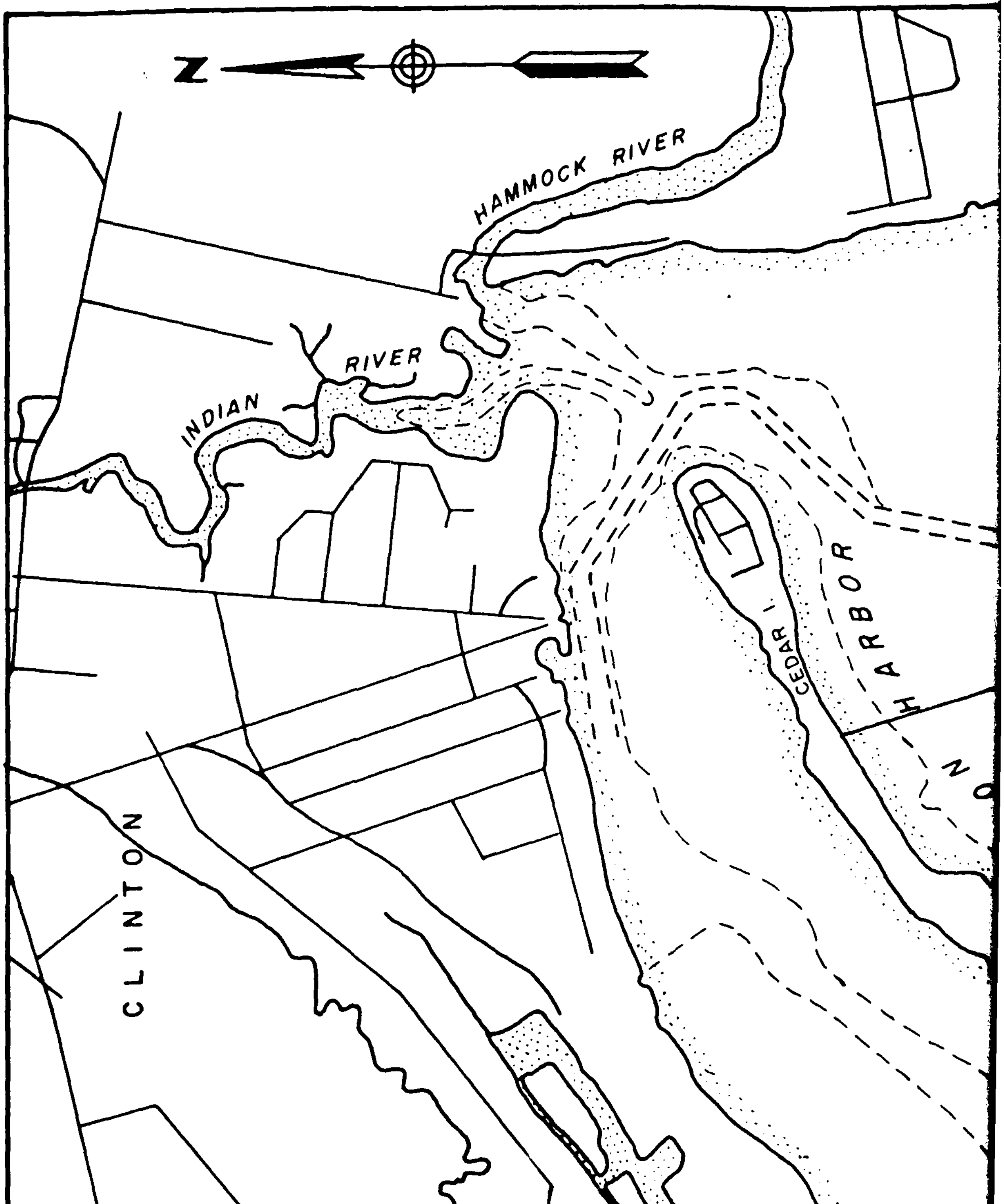
sand structures adjacent to the retaining dikes at elevations between 2.5 and 5.0 mean low water. An additional 13 acres of Spartina patens would be developed on the sand structures at elevations of +5 to +6 mean low water. Fifteen acres of unvegetated intertidal sand flat at elevations from 0 up to +2.5 mean low water would be untouched. Thirteen acres of unvegetated to sparsely vegetated sand nesting area at elevations +6 to +7 would be created on the tops of the dredged material mounds. Lastly there could be about 28 acres of shallow subtidal area at elevations between -1 and mean low water. This is shown on figure V-20.

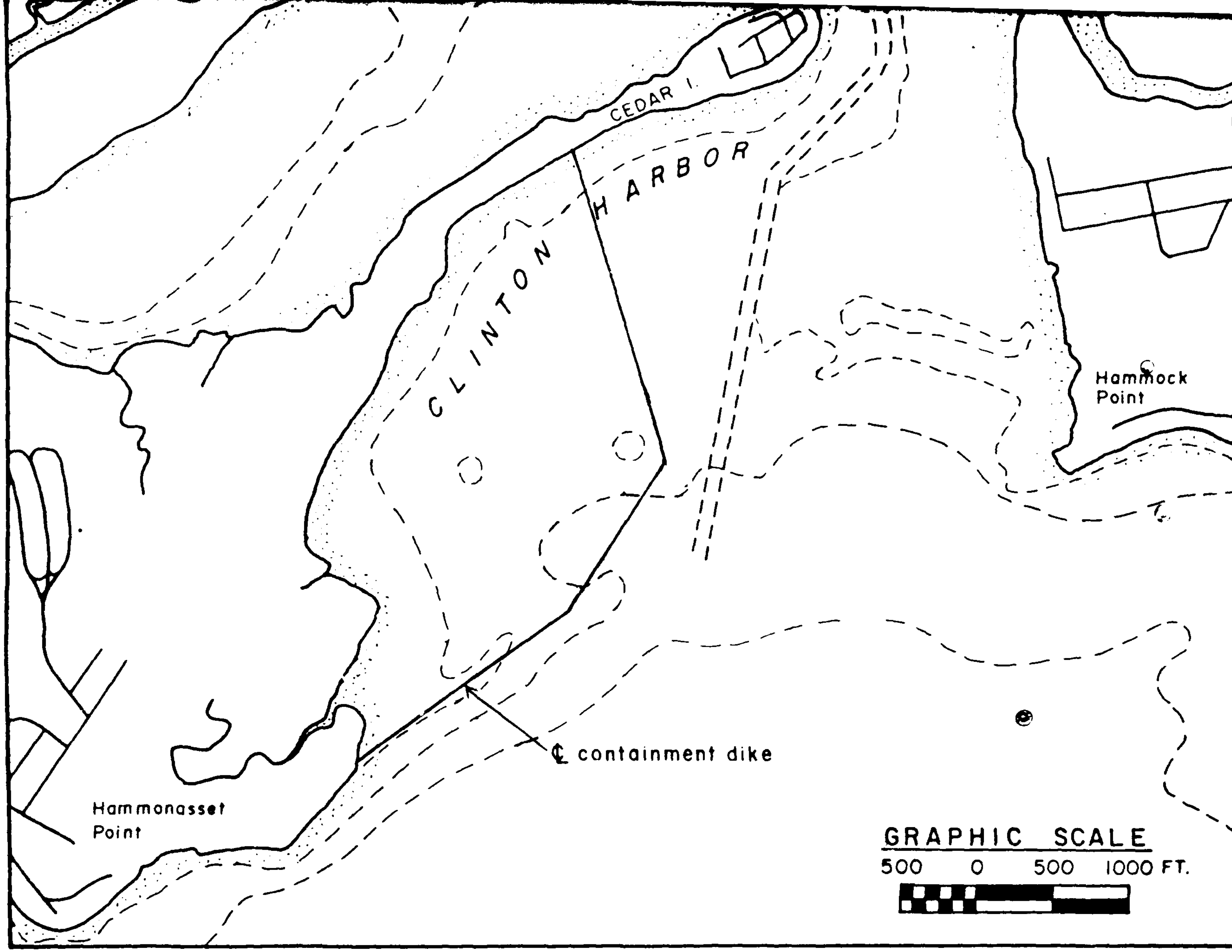
Although this facility is capable of storing up to 1 MCY of material, there is presently no need to make the facility that large. The annual operation and maintenance (O&M) dredging volume is about 4200 cubic yards. The facility would have a planned life of about 25 years. Hence, to accomodate the O&M portion of dredging, the facility would have to store 105,000 cubic yards. The facility would also be designed to handle all private (permit) dredging in the town. It is difficult to arrive at actual annual volumes of dredged material removed from the harbor. It has been assumed that approximately 20,000 cubic yards/year is removed annually. (One permit alone authorizes a marina owner to remove 17,000 yards/year.) Over a 25 year period this amounts to 500,000 yards. Lastly, there is a request for a harbor improvement project presently being processed. The approximate volume of dredged material to be generated from that project is about 150,000 cubic yards. Hence the volume for the 25-year planning period would be about 750,000 cubic yards assuming all material dredged would be disposed of inside the facility.

The difference between the present design and the optimal usage is about 250,000 cubic yards. For the purposes of the report, this does not represent a significant difference between the planned amount and what could actually be pumped into the facility. In all likelihood, the length of the dikes as presently planned could be moved closer to shore and further away from Cedar Island. However because of reducing the amount of "deep" water available for storage of dredged material, the actual percent reduction of the length of dikes would not correspond to the 25% reduction between 750,000 cubic yards and the 1,000,000 cubic yard capacity.

Sub-surface explorations were conducted at the Clinton site. While the foundation soils will not support a containment facility height greater than about +6.0 feet MLW (limiting containment volume), the foundation soils are suitable to support a lower retaining dike necessary for a marsh creation project. The geotechnical engineering prototype report is included in this report immediately following the Environmental Impact Report and the geotechnical engineering screening report of 5 preliminary sites. Included in the report are the plan of explorations, boring logs, soil test results, a soil profile, and cross sections of the proposed retaining dike.

The design of the dike was based upon the sub-surface conditions at the site and the storm conditions which subjects the site to a maximum


N
HAMMOCK RIVER
INDIAN
RIVER
CLINTON
CEDAR
HARBOR



LOCATION MAP, CLINTON HARBOR, CONNECTICUT

FIGURE V-19

2

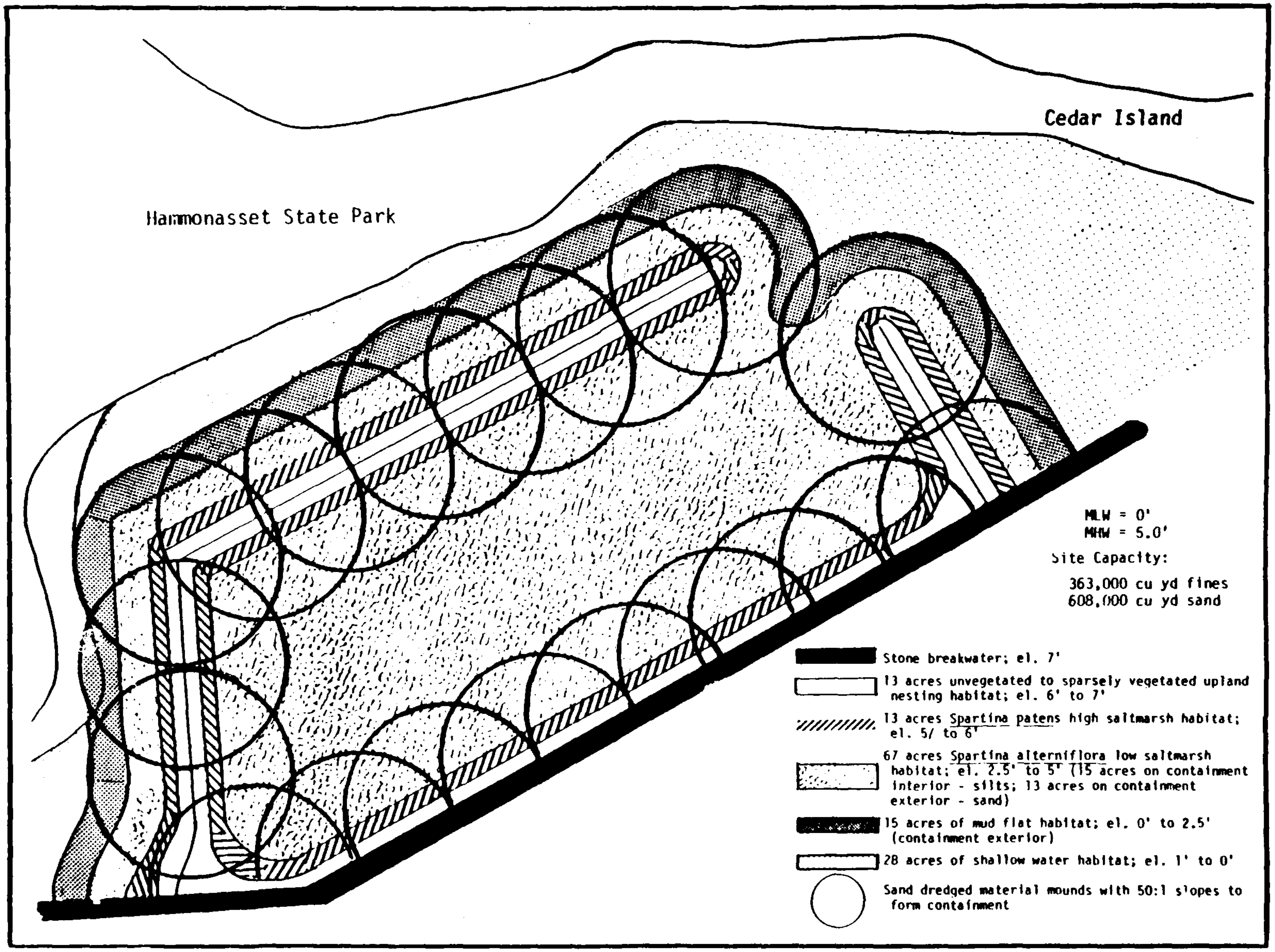


Figure V-20 Distribution of wetland habitats on dredged material containment facility.

design wave of 6 feet. All conditions are detailed in the geotechnical engineering report. In summary, the facility would require about 4800 linear feet of dike. Top elevation of the proposed retention dike is +6 MLW. Less than 2 feet of the dike would be exposed at high tide. At low tide, six feet of the dike would be exposed. The overall maximum height of the structures would be about 12 feet at the area of maximum depth. The total construction cost is approximately $1,330,000, exclusive of the weir structures.

The socioeconomic impacts of the marsh creation project has previously been prepared as part of the Social and Economic Impact Report. They are summarized below.

- Creation of additional new marsh using dredged material adjacent to an existing but eroding marsh is viewed as a net benefit to the area. This conclusion is based on expressed desires to protect the existing marsh and to add to wildlife habitat in the area.

- The site is relatively distant from residental areas so that potential aesthetic impacts, such as odors and noise, would be small.

- The potential for enlarging existing vector problems should be considered along with mitigation measures should some be necessary.

- Short term interruptions such as loss of panoramic view traffic congestion, and possible boating hazards due to the presence of heavy construction equipment placements during construction may occur but the overall impact of these activities is considered small.

- A shellfish area on the south side of the DMCF may be disturbed.

Full breakdown of the impacts are presented in the Social and Economic Impact Report. A line item breakdown of impacts appears on the following 8 pages. A further description is contained in Social Considerations immediately following the Environmental Impact Report. Since preparation of the socio-economic impact report, the method of construction and configuration has changed slightly. This breakdown has been adjusted accordingly. The dikes will be built from about 60,000 yards of material trucked to the site rather than by hydraulic pipeline, and 100 acres of marsh will be created. (This scenario was also evaluated by the consultant although no table of impacts prepared.)

At the present time a wave run up - deposition study is being prepared for the Clinton - Hammonasset marsh creation project. The results of this study should be available by March 1983.

In summary, it appears that the Clinton project is feasible from all perspectives. It would result in net overall environmental benefits. It would provide a very economical means of disposing of dredged material without any potential harmful impacts. There would be relatively few

SITE: CLINTON HARBOR

PRIMARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Small	Floating pipeline principal hazard. Some recreational and fishing boats may be exposed. No summer dredging.
• Construction Hazards	Small	Materials will be trucked to site.
• Final Use Hazards	Not applicable Short-term	
• Traffic Congestion	Small	Assumes riprap is trucked in through high volume entrance to Hammonasset Beach, during off-season.
• Vectors	Small	Already many insects in surrounding marsh. Must be mitigated carefully to keep impact small.
• Particulates	Negligible	Material will be under water most of time, or vegetated within year after exposure.
2. COMMUNITY ORGANIZATION		
• Displacement	None	
• Zoning Compatibility	Not applicable Short-term	
• Accessibility	Moderate	Land access by foot only, but many boats in the area.
• Community Services	None	No police addition expected.
• Perceived Need	Not applicable Short-term	

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	Negligible	100 acres of marsh will be added, to west of all existing housing.
• Employment	Moderately beneficial	Some semi-skilled and unskilled help possibly required including planting marsh grasses.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Small	Little impact expected on Hammonasset State Park or Clinton Harbor because of limited dredging June thru September.
• Educational Opportunities	Small	Viewing of construction and marsh planting and successional growth.
• Cultural Resources	Negligible	Historical Society in Town Hall. (See Appendix F.)
• Historical Significance	None	Old dumping ground for sailing vessels.
5. AESTHETICS		
• Noise	Small	Assume no night work and little to no dredging June through September.
• Odors	Small	Distant from populace and only clean material involved.
• Exposure	Small	Distant from populace and view obscured by existing marsh grass.
• Compatibility	Small	Construction activities may be obtrusive to residents of Cedar Island.
• Panoramic View	Moderate	Impact primarily associated with boaters and residents of Cedar Island and Hammock Point.

SITE: CLINTON HARBOR

SECONDARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Negligible	Few boats visit beyond one mile during off-season.
• Construction Hazards	Small	Material will be trucked in along turnpike.
• Final Use Hazards	Not applicable Short-term	
• Traffic Congestion	Negligible	About 65,000 cy of construction material to be transported. Major transport routes utilized.
• Vectors	Negligible	No problems expected.
• Particulates	Negligible	Some dust may be created by trucks.
2. COMMUNITY ORGANIZATION		
• Displacement	None	
• Zoning Compatibility	Not applicable Short-term	
• Accessibility	Negligible	Relatively few roads in the community provide access to site--few visitors expected if construction not in summer.
• Community Services	None	None expected to be required.
• Perceived Need	Not applicable Short-term	

SITE: Clinton Harbor (continued) SECONDARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	None	Sufficient distance.
• Employment	Negligible	Opportunities temporary--unemployment rate low.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Small	Few recreationists during November-April construction period.
• Educational Opportunities	Negligible	A few people may visit construction site.
• Cultural Resources	Negligible	No effect expected, as long as trucks routed on high capacity roadways.
• Historical Significance	Negligible	No effect expected, as long as trucks routed on high capacity roadways.
5. AESTHETICS		
• Noise	Negligible	None expected to exceed 70 db for any considerable length of time.
• Odors	Negligible	Duration limited--though worst conditions might allow permeation beyond one mile.
• Exposure	Negligible	Relatively few vantage points.
• Compatibility	Negligible	Obtrusive character of machinery reduced by distance.
• Panoramic View	Negligible	Distance sufficient that even a 6 ft MLW dike would not be noticeable.

SITE: CLINTON HARBOR | PRIMARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Negligible	Not an obstruction.
• Construction Hazards	Not applicable Long-term	
• Final Use Hazards	Negligible	Final use as marsh planned.
• Traffic Congestion	Negligible	No increase expected.
• Vectors	Moderate	Drainage system must function properly, reports of problems with adjacent ditches.
• Particulates	Negligible	Once marsh grasses are planted.
2. COMMUNITY ORGANIZATION		
• Displacement	None	Field data (fall 1981) indicate no shellfish beds need be displaced.
• Zoning Compatibility	Negligible	A marsh should be acceptable, even next to summer homes, since that is present condition.
• Accessibility	Moderately beneficial	Access by foot only-- any haul road must be temporary.
• Community Services	Negligible	No addition on maintenance crew expected.
• Perceived Need	Moderate	Marsh creation would remedy the effects of past marsh filling, and protect existing marsh from erosion.

SITE: Clinton Harbor (continued) PRIMARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	Negligible	Will not affect beach access of any summer residences.
• Employment	Negligible benefit	Few, if any, new jobs will be created.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Moderate benefit	More marsh created to explore.
• Educational Opportunities	Moderate benefit	Potential for school trips to observe marsh development.
• Cultural Resources	Negligible	Historical Society in Town Hall.
• Historical Significance	None	
5. AESTHETICS		
• Noise	Negligible	No noise expected.
• Odors	Negligible	No new source beyond normal marsh smell.
• Exposure	Moderate	Hammonasset Beach--about 100,000 visitors a year to Meigs Points, alone. More to beach area.
• Compatibility	Negligible	Minimal impact from land.
• Panoramic View	Moderate	Six-foot gently sloped dike will blend with present coastline.

SITE: CLINTON HARBOR — SECONDARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	None	
• Construction Hazards	Not applicable	
• Final Use Hazards	None	
• Traffic Congestion	None	
• Vectors	Moderate	More wetland (100 acres) available for vector source.
• Particulates	None	
2. COMMUNITY ORGANIZATION		
• Displacement	None	
• Zoning Compatibility	None	
• Accessibility	Moderate	
• Community Services	None	
• Perceived Need	Moderate	There is local enthusiasm to remedy the effects of past marsh filling.

SITE: Clinton Harbor (continued) SECONDARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	None	
• Employment	Negligible beneficial	
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Negligible beneficial	
• Educational Opportunities	Moderate beneficial	Site will expand opportunity for study of nature and marsh restoration.
• Cultural Resources	Negligible	
• Historical Significance	Negligible	
5. AESTHETICS		
• Noise	None	
• Odors	None	
• Exposure	None	
• Compatibility	None	
• Panoramic View	None	People in secondary impact area are outside view area.

social impacts, mostly all short term. A marsh creation project at Clinton is a viable project.

Black Ledge, Groton

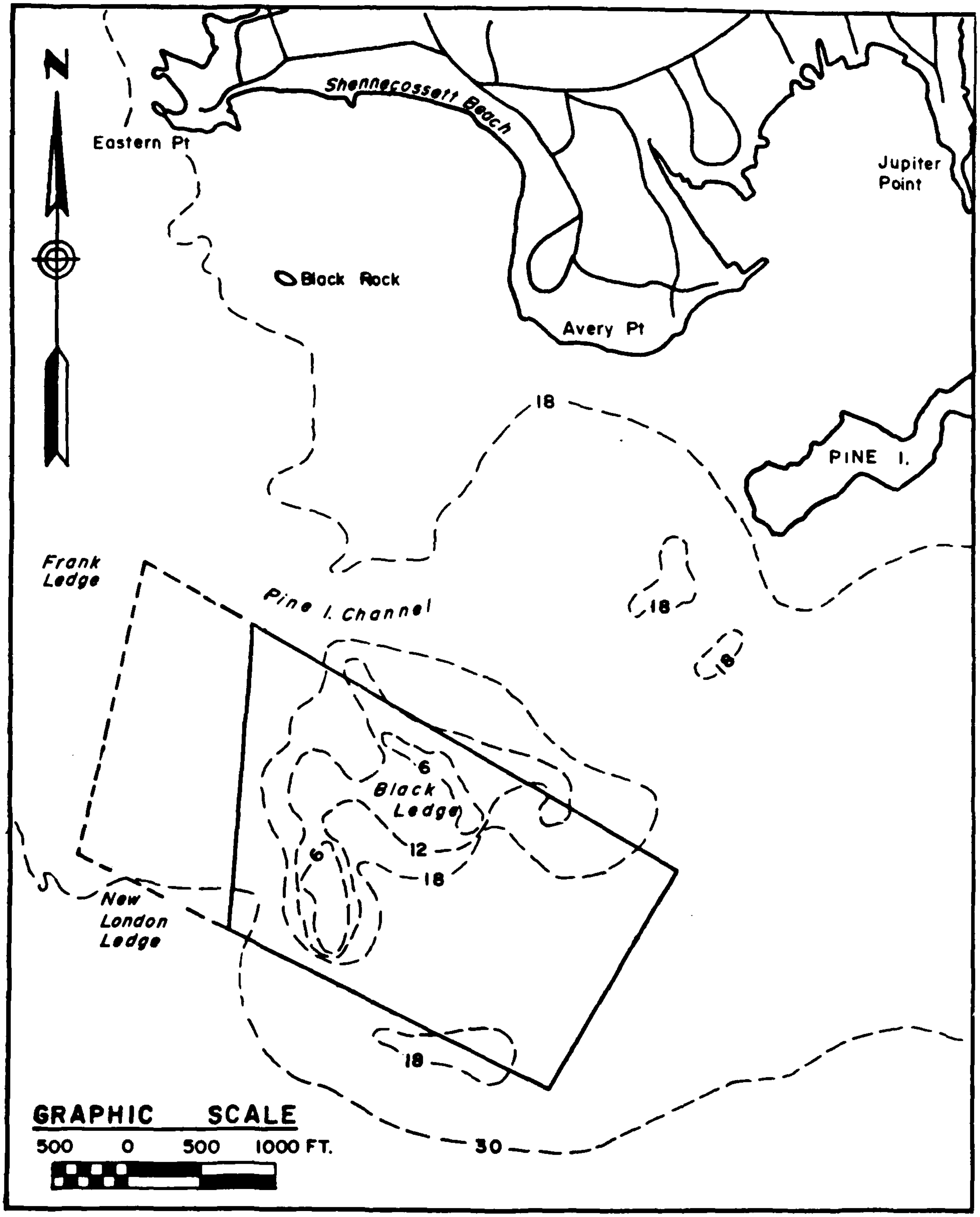
The city of Groton Conservation Commission has long favored consideration of a containment facility at the Black Ledge site to handle disposal of dredged material from the Thames River. They were the first group to request consideration of a site. The site has always been centered on Black Ledge which has been reported to be a hazard to boating. Since initiation of our involvement with the project, the limits of the project have changed slightly. The original configuration is shown on Figure V-21 along with the present scheme.

This site differs considerably from the Clinton site in that it is a true containment facility and is built offshore in an average of about 20 feet of water. It will contain dredged material having potentially high concentrations of metals and therefore the facility must be designed differently from a marsh project. The core of the dike would be built of quarry spalls (0 - 50 lbs) with a filter blanket if necessary to stop dredged sediments from migrating through the dike.

A detailed environmental testing and evaluation program was also undertaken at the Black Ledge site. The results of this effort are included in the Environmental Impact Report attached to this document. This site is not as environmentally favorable as the Clinton site. If a containment facility were constructed at this site there would be a net environmental loss. This does not include any environmental benefits which might accrue to the project such as the protection of the shoreline and any reduction in impacts evident from the present practice of open water disposal at the New London dumping grounds. There is a significant mussel concentration at the site. In fact the mussel cover was at least one layer thick on most submerged rocks, but occassionially two and three layers were found. The mussel cover was so complete that the scuba divers had difficulty in observing the underlying rock. By constructing a containment facility at Black Ledge approximately 75 percent of the mussel population would be eliminated. A partial recovery of the mussel resource could be realized by the availability of the riprap surface offered by the dike system.

Similarly to the Clinton site a subsurface investigation was undertaken at Black Ledge to determine foundation conditions. A segment of the containment facility immediately adjoining the lighthouse was eliminated due to poor foundation conditions discovered when borings and probings were done. Also it was later determined that this same area is used as a short cut from the Federal channel to the various outlying islands.

The total length of the exterior retaining dikes is approximately 9600 linear feet. The maximum height of the structure is +13.5 above mean



LOCATION MAP, BLACK LEDGE, GROTON, CONNECTICUT

FIGURE V-21

low water and the maximum depth of water in which the facility will be built approaches 35 feet mean low water. At high tide, about 12 feet of the dike would be exposed. At a 100-year storm occurrence, the dike would not be overtopped. Hence, portions of the dike may be as much as 50 feet above the bottom of the floor of Long Island Sound. As the foundation conditions at Black Ledge are better than at Clinton, a steeper dike slope is possible. The design slope is 1 foot vertical on 1.5 feet horizontal. even with the steeper slope considerable volumes of material have to be placed in the dike itself. An overall breakdown is as follows:

1000 - 2000 lb Armor Stone	88,800 cy
300 - 600 lb Armor Stone	27,000 cy
100 - 200 lb Underlayer Stone	162,600 cy
30 - 60 lb Underlayer Stone	42,000 cy
Quarry Spalls to 50 lb	883,800 cy
	1,204,200 cy

Hence over 1,200,000 cubic yards of material would go into building the containment facility providing an approximate 125 acre surface area. This volume determination is exclusive of two cross dikes which would segment the facility into three cells. As the facility is well offshore all construction would have to be by barge. The placement of the dike core material will be by bottom dump barges to an elevation of about -10 MLW. Above this, placement will be by cranes operating from floating barges. The crest elevation of the core will be maintained at +6 MLW. Once a section of the core has been completed, the required bedding layers and stone slope protection will be placed by cranes from floating barges adjacent to the dike. Design considerations along with the plan of explorations, soil test results, soil profile and dike cross sections are in the geotechnical engineering prototype report attached to this document. The total cost of the Black Ledge project is $30,600,000 exclusive of a weir structure cross dikes, and a rehandling facility. The approximate volume of materials capable of being stored is approximately 7.5 MCY.

The dredging volumes expected to come out of New London Harbor (including all the Thames) for operation and maintenance alone amounts to 26,000 cubic yards a year. Assuming a 25-year design life, this is equivalent to 650,000 cubic yards of dredged material. The Economic Analysis of Future Dredged Material Disposal in Long Island Sound prepared for the Programmatic EIS indicates a potential improvement project at New London which would generate an additional 1.6 MCY of material. Permit dredging (Navy projects included) are very difficult to put on an annual volume relationship. The same report indicates an amount of 5.5 MCY over a 50 year period for the entire Eastern Coastal Area of Long Island Sound. For the purposes of this report, most of this volume will probably be generated from the New London area. Therefore, it can be assumed that approximately 2.5 MCY will require disposal. Therefore the total dredging volume for the Thames - New London area is equal to 4.75 MCY. As

mentioned above, the facility is designed for approximately 7.5 MCY. It is assumed that the facility could be reduced in volume by about 1/3 which would result in a reduction of about 2000 linear feet of dike. This is not a major change but could bring the cost down to approximately $25,000,000.

An additional problem inherent to the Black Ledge site is that it is fairly well removed from the dredging sites. Hydraulic dredges of the size which may be used on the Thames River could pump an absolute maximum of 2 miles. Only a small portion of the Federal project is within this distance. In all likelihood, the dredging of the Thames will have to be done by the conventional barge/scow system. This will then require either a pump out facility or a rehandling basin capable of storing the dredged material being dumped from the barges/scows. This adds significant expense to the project along with introducing additional environmental concerns. However, it is possible that hopper dredges could be used for this harbor (they have been used there in the past). This would partially solve the rehandling problem although a section of the retaining dike would have to be made of steel sheet piling so as to allow for the hopper dredge to pull up alongside it. This increases overall cost. Commercial hopper dredges are generally not found in this portion of the U.S. due to the small volumes of material being dredged. Such usage on a large scale is unlikely.

The socio-economic impacts are also more significant then at Clinton. The major items are summarized below.

- The large volume of dike material required may result in significant traffic congestion and construction hazards during the short term.

- Boating hazards associated with vessel movements to and from the DMCF during development and operation may result because of the large volume of recreational and commercial boat traffic at the entrance to New London Harbor.

- The long operating life of the facility would extend these concerns for a long time.

- Displacement of marine life would unavoidably result from the island creation project.

- Although the site is some distance offshore its size would reduce the panoramic view from shoreline. The DMCF island, however, would be similar in appearance to other nearby islands.

- The issue of jurisdiction of the created lands was identified.

- Local authorities are concerned that the DMCF would be an attractive nuisance to area boaters which would be difficult to supervise.

The following 8 pages list specific socioeconomic impacts. The full impacts and discussions are contained in the socioeconomic report available from this office while sufficient quantities of copies remain. Additional discussion is contained in the Social Considerations Section following the Environmental Impact Report.

It is assumed that the project will be established as a wildlife sanctuary after completion of the retaining dikes and initial filling of one of the containment cells. As the dredged material will have the potential to hold relatively high concentrations of contaminants, the plan for ultimate use of a completed cell would require that there be approximately 2 feet of clean fill/topsoil placed on top of the dewatered/densified dredged material. An overall management plan will be developed before the completion of the final report if the site proves to be viable and has public support.

The site of this potential containment facility is near the location of the interim disposal site at New London. While significant transportation cost savings in the disposal of dredged material are apparent at the Clinton site, there would not be any cost savings for the Black Ledge site.

In summary, while there were many negative impacts attributed to the construction of a containment facility at the Black Ledge site, there is no one reason why the site cannot be viable, at least as an alternative, to open water disposal. If for some unknown reasons, open water disposal in Long Island Sound were to be discontinued, the potential impacts at the Black Ledge site would be far less than at most other sites investigated to date. The advantages of creating a wildlife habitat and the overall containment facility should offset some, but not all, of the environmental harms.

Other Potentially Feasible Sites

Considerably more detailed information was obtained for the Clinton and Black Ledge sites than for the other sites being considered as potential containment sites. Much of the data acquired was of an equivalent final stage feasibility study level of detail. While other minor planning studies need be done at both these sites to conclusively evaluate them, the majority of future work efforts will focus on determining the levels of detail necessary for the remaining sites under consideration.

The following are potential candidate containment sites. At most of these sites some preliminary data has been compiled but more detailed information is necessary before a conclusion as to the overall feasibility of an individual site can be made. Where possible, findings to date have been included.

SITE: BLACK LEDGE/NEW LONDON HARBOR PRIMARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Large	Many vessels in channel; Block Island Ferry and recreational boats forced into channel.
• Construction Hazards	Moderate	Large volume of dike fill to be transported to and deposited at site. However, site accessible to boaters only.
• Final Use Hazards	Not applicable Short-term	
• Traffic Congestion	Large	Only if dike material is trucked to barge dock. Negligible if rail used.
• Vectors	Negligible	Large acreage, but reasonably far from shore--some mitigation may be required.
• Particulates	Negligible	Island abo. 1/2 mi from land; duration temporary; small areas of active work.
2. COMMUNITY ORGANIZATION		
• Displacement	Large	Lobsters and clams have been reported on or near site.
• Zoning Compatibility	Not applicable Short-term	
• Accessibility	Negligible	By vessel only
• Community Services	Moderate	Not clear if outside local police jurisdiction. Contractor should arrange for hospital services for anyone injured at site.
• Perceived Need	Not applicable Short-term	

SITE: Black Ledge (continued) PRIMARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	Negligible	Even a house built near Hobbs Island recently had no effect; construction temporary.
• Employment	Moderately beneficial	Especially if a local company does the dredging.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Moderate	Construction/filling activities may interfere with recreational boating.
• Educational Opportunities	Small	Can be reached only by boat. The size will attract a segment of the boating population.
• Cultural Resources	Small	Ocean Beach in New London, and UConn branch campus and Coast Guard research center at Avery Point.
• Historical Significance	Moderate	New London Ledge Lighthouse near site corner is currently being renovated and manned. Listed in the National Register.
5. AESTHETICS		
• Noise	Moderate	Assumes no construction done at night.
• Odors	Negligible	Site remote from land; will be filled in increments; material under water most of time.
• Exposure	Moderate	Ocean Beach just inside 1 mile radius. Avery Point has about 800 people, and visitors.
• Compatibility	Moderate	Large machinery obtrusive, especially from Eastern Point to Avery Point.
• Panoramic View	Large	The dike will be 14 ft above MLW, similar to adjacent natural islands.

SITE: BLACK LEDGE/NEW LONDON HARBOR PRIMARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Moderate	More boats will be forced into channel than by existing underwater ledges. Reduced size would mitigate.
• Construction Hazards	Not applicable Long-term	
• Final Use Hazards	Moderate	High dike with large riprap surface would make visits by people somewhat hazardous.
• Traffic Congestion	None	
• Vectors	Negligible	Site should be carefully drained.
• Particulates	Negligible	No significant quantity after grass planted.
2. COMMUNITY ORGANIZATION		
• Displacement	Large	Displaces lobster and clam beds.
• Zoning Compatibility	Negligible	Not zoned, but acceptable as open space or wildlife sanctuary.
• Accessibility	Moderate	Only boats have access but size will continue to attract the curious--though no more than other nearby natural islands.
• Community Services	Moderate	Site outside police jurisdiction and emergency arrangement should be made.
• Perceived Need	Moderate	Site recommended by local conservation group for expanding available wildlife habitat.

SITE: Black Ledge (continued) PRIMARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	None	None expected, even recent house near Hobbs Island had no effect.
• Employment	Negligible	Possible maintenance jobs.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Negligible	Unless plans made to use site as park.
• Educational Opportunities	Moderate beneficial	Development as island habitat.
• Cultural Resources	Moderate	Avery Point has UConn branch campus Coast Guard research center and Ocean Beach Park just inside primary impact area and could be adversely affected by altered aesthetics.
• Historical Significance	Small	Precautions must be taken to insure the historical characteristics of New London Ledge Lighthouse.
5. AESTHETICS		
• Noise	None	
• Odors	None	None from site after material dries out and is capped.
• Exposure	Moderate	Several beach sites in area.
• Compatibility	Large	Area character modified by the 125-acre man-made island. Smaller facility would mitigate impact.
• Panoramic View	Large	Dike is 14 ft above MLW. Area is large;Avery Pt only 0.3 mi away. It will appear similar to adjacent natural islands.

SITE: BLACK LEDGE/NEW LONDON HARBOR SECONDARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	None	
• Construction Hazards	Not applicable Long-term	
• Final Use Hazards	None	
• Traffic Congestion	None	
• Vectors	None	
• Particulates	None	
2. COMMUNITY ORGANIZATION		
• Displacement	None	
• Zoning Compatibility	None	
• Accessibility	Negligible	
• Community Services	None	
• Perceived Need	Moderate	Desirable addition to wildlife habitat.

SITE: Black Ledge (continued) SECONDARY IMPACT AREA / LONG-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	None	
• Employment	Negligible Beneficial	
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Negligible beneficial	
• Educational Opportunities	Negligible beneficial	
• Cultural Resources	Negligible	
• Historical Significance	Negligible	
5. AESTHETICS		
• Noise	None	
• Odors	Not Applicable	
• Exposure	Negligible	
• Compatibility	Negligible	
• Panoramic View	Negligible	People in secondary impact area are outside view area.

SITE: BLACK LEDGE/NEW LONDON HARBOR SECONDARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
1. LIFE, HEALTH, AND SAFETY		
• Boating Hazards	Moderate	Material probably brought by barge outside one mile.
• Construction Hazards	Moderate	Location of source for dike material not yet determined. Assumes trucking of material.
• Final Use Hazards	Not applicable Short-term	
• Traffic Congestion	Moderate	If trucks are used; otherwise none.
• Vectors	Negligible	No problem resulting from site expected for whole community.
• Particulates	Negligible	Some dust--primarily from trucks if utilized.
2. COMMUNITY ORGANIZATION		
• Displacement	None	
• Zoning Compatibility	Not applicable short-term	
• Accessibility	Negligible	Access only by water--few visitors expected from secondary impact area.
• Community Services	None	
• Perceived Need	Not applicable Short-term	

SITE: Black Ledge (continued) SECONDARY IMPACT AREA / SHORT-TERM

CATEGORY/ATTRIBUTE	DEGREE OF SEVERITY	RATIONALE
3. FINANCIAL		
• Land Value Changes	None	
• Employment	Negligible	Duration temporary.
4. EDUCATIONAL, CULTURAL, AND RECREATIONAL		
• Recreational Opportunities	Small	Construction and disposal operations not scheduled during recreation season.
• Educational Opportunities	Negligible	A few curious boaters may visit the site.
• Cultural Resources	Negligible	
• Historical Significance	Negligible	
5. AESTHETICS		
• Noise	Negligible	None expected to exceed 70 db for any considerable duration.
• Odors	None	
• Exposure	Moderate	Many beaches, beach clubs, and homes on hillsides.
• Compatibility	Negligible	Obtrusive character of machinery reduced by distance.
• Panoramic View	Moderate	Site will be observable beyond one mile.

Sherwood Island Borrow Hole - Westport, CT. - Some preliminary estimates of available storage has been conducted at this site using soundings. The approximate volume is 750,000 cubic yards. It has been reported that because of anaerobic conditions in the borrow hole, ecological value is minimal. The plan as advocated by State officials, calls for filling in this hole with dredged material and using it for a shellfish leasing tract. No island would be created although the possibility exists that a small island could be established as a bird sanctuary if necessary to conform to study authority or intent. Neither environmental, socio-economic nor design analysis were conducted at this site.

Penfield Shoal/Reef-Fairfield, CT. - This site was recommended by the Fairfield Conservation Commission. It would be a shoreline extension project. Several different preliminary alternative containment plans have been developed with a storage volume between 1 and 4 MCY. This facility would be built in reasonably shallow water; approximately -6 feet MLW. None of the problems inherent in the construction of Black Ledge would be evident as it could be built from shore. The estimated cost would be less than $10 million dollars. Some preliminary environmental base line data collections have been undertaken which show the reef itself to support a very dense and diverse benthic community. However with careful siting a shoreline extension project may be possible. The U.S. Fish and Wildlife Service feels this site is a very sensitive ecological area and any proposal could be harmful to marine life. A copy of their planning aid letter is attached in the appendices. Also attached is a copy of the geotechnical engineering screening report which discusses this site along with sone design criteria. Dredged material would come from Bridgeport, Black Rock Harbor plus Ash Creek. Penfield shoal is within the limits of distance capability of a large hydraulic dredge for these channels.

Milford Harbor Jetties - Milford, CT. - This site was recommended by the Milford Harbor Improvement Commission. The location of this site would be near the present west breakwater. Several variations of this proposal are also possible depending upon site favorability and local acceptance. One variation calls for extending the breakwater seaward by about a thousand feet. This extension will be one side of a multi-celled facility. The other walls, would be built off of the newly built breakwater/retaining dike so that the overall configuration would be about 500 feet by about 1000 feet. Another configuration calls for building a marsh restoration project.

The first alternative would have a capacity of about 400,000 cubic yards and cost about $2.3 million. Dredged material for this site would be limited to the Milford Harbor area as this site would be within a hydraulic dredge's range. U.S. Fish and Wildlife comments are contained in the Planning Aid Letter. The results of the baseline environmental studies indicates that Milford Harbor does not have as diverse a mixture of taxa as Penfield Reef. It is more representative of a typical estuarine habitat. The fauna are primarily polychaetes (worms). The biomass is generally low.

Gold Star Bridge - New London, CT. - This site is located on the Thames River just upstream of the Gold Star Bridge at I-95, on the west side of the river. It was recommended by an official for the Connecticut Department of Transportation. From a siting perspective, it is in an ideal location. It is well protected from the high waves, in an area where hydraulic dredging can be used, in an area where there is industrial development/naval operations, and adjoining land which is State owned. However, during the geotechnical engineering screening effort, their research indicated that the subsurface conditions at this site precluded any type of economical dike section without excavation of the substrata. Environmentally, there does not appear to be any reason which would rule out the site for further consideration. However a detailed set of borings would be necessary to verify the substrata and to allow for a design determination.

Mamaroneck Harbor, NY. - Several sites were recommended by local interests in this harbor. These sites are near the Scotch Caps, Crane Island, Pope Rocks and Crab Island. The Scotch Caps are located on the east side of Milton Harbor. The rock outcroppings, ledges and reef structures provide excellent habitat for organisms such as rock week, mussels, barnacles and other invertebrates. It is also an excellent lobster habitat and supports a commercial fishery. For environmental reasons, this site was eliminated. Crane Island and Pope Rocks exhibit the same type of reef system as Scotch Caps and also were eliminated. However Crab Island - Black Tom while also being similiar to the above two general areas, is smaller in size and does not have as much diversity of species. Preliminary geotechnical engineering data collections and design were performed for this site. It would be a shoreline extension project having a triangular shape with each side approximately 1600 feet. The total volume capable of being contained is 500,000 cubic yards and it would cost slightly over $4,000,000. It is assumed that a small hydraulic dredge would be used in Mamaroneck and it should be capable of reaching the disposal site. All material would come from Mamaroneck Harbor. While the site was recommended by local interests it appears unlikely that a facility would be built at this site due to the conjested nature of the harbor and its affluent surroundings.

Yellow Mill Channel - Bridgeport, CT. - This site would involve closing off the tidal portions of the channel from a point just upstream of a sand and gravel operation above the I-95 bridge. A closing would be made across the channel. It would involve only 500 feet of dike. The contained area is capable of storing about 400,000 cubic yards of material. The costs are reasonably minor - $400,000.

However significant interior (fresh water) drainage would have to be routed through the containment facility. No detailed costs were developed. However, it was assumed that an additional $1,000,000 would be required to continue the drainage networks through the containment facility. Environmentally, Yellow Mill Channel is a severely stressed water body and under existing conditions is of low value to Fish and

Wildlife resources. If a containment facility was to be built here, it would be an ideal location for a recreational facility once the facility is filled to capacity. The geotechnical engineering report and Fish and Wildlife reports discuss this site and their summaries are in the appendices to the report. Social and economic aspects are contained in the detailed report and general information impacts are identified in the social considerations section.

Flushing Bay - New York, N.Y. - This site was recommended by the New York New Jersey Port Authority. It is actually located out of the study area on the East River. The New York District of the North Atlantic Division of the Corps of Engineers is currently investigating the possibilities of creating a small marsh restoration project at this site.

Four other sites, Housatonic River Breakwaters, Guilford Harbor, I-95 interchange at West Haven and Menunketesuck Island have been suggested for evaluation by local interest groups. No evaluations of these sites has been made by the office at this present time. The Housatonic River and Menunketesuck sites appear to offer some potential whereas the other two are actually upland sites previously used for disposal of dredged material. Some preliminary environmental studies and engineering investigation will be made of these sites when sufficient funds and interest becomes evident.

The following tables, V-13, V-14, and V-15 summarize all sites evaluated to date. Table V-13 contains a listing of all sites investigated in the Reconnaissance Report. Table V-14 - all sites in Connecticut screened in the intermediate screening evaluations and Table V-15 - all sites similarly investigated in New York. The tables all list the reason why a site was eliminated from further screening or considerations, or it indicates which sites remain viable as containment facilities. It should be noted however that even a slight change in location would drastically effect consideration of the site.

SITE	ENVI
Groton Fisher Island	
New London - Open Water Dump	
Bartlett Reef - Offshore Waterford	
Hatchett Reef - Offshore Old Lyme	
Cornfield Shoals - Open Water Dump	
Clinton - Six Mile Reef to Cornfield Shoals	
Clinton - Six Mile Reef	
Long Sand Shoal	
Duck Island Lighthouse & Breakwater Offshore Westbrook	
Guilford - Falkner Island	
New Haven - Tidal Flat E. Side of Hbr. Adjacent to E. Shore Park	
New Haven - Tidal Flat W. Si'e of Harbor Near Long Wharf	
New Haven - Tidal Flat Breakwater Mouth of Old Field Creek & Sandy Point Breakwater	
New Haven - 20 Square Miles Near Historic Dump Site	
W...es Point - West Haven	
C..rles Island - Offshore Milford	
Milford Point - Milford	
Point-No-Point - Stràtford	
Bridgeport Breakwater, W. Breakwater & Tongue Point	
Pine Creek Point - Fairfield	
Cockenoe Island - Norwalk Islands	
Greens Ledge - Offshore Norwalk	
Cable and Anchor Reef	
Georges Rock	
Stamford - Breakwaters to the Cows	
Stamford - R32A Shoals	
Goose Island - Offshore Greenwich	
Little Captain's Island - Offshore Greenwich	
Area Outside Calf Island - Offshore Greenwich	

TABLE V-13
STAGE I
SITES CONSIDERED IN RECONNAISSANCE REPORT

	REASON FOR REJECTION: ENVIRONMENTAL	SOCIAL	COST	SIZE	DISTANCE TO DREDGING	WARRANTS FURTHER EVALUATION
	X	X				
			X			
	X	X				
	X	X				
			X			
						X
						X
	X	X				
	X	X				
	X	X				
ore Park						X
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	X	X				
	X	X				
	X	X				

AD-A128 227 THE LONG ISLAND SOUND DREDGED MATERIAL CONTAINMENT FEASIBILITY STUDY(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 83

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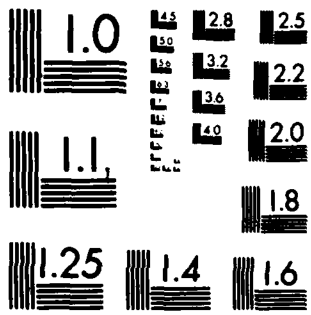

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE V-14
INTERMEDIATE SITES CONSIDERED
CONNECTICUT

SITE	CITY OR TOWN	RECOMMENDED BY: REPORT	RECOMMENDED BY: LOCAL REQUEST	REASON FOR REJECTION: ENVIRONMENTAL	SOCIAL	COST	SIZE	DISTANCE TO DREDGING	WARRANTS FURTHER EVALUATION
Barn Is. Hunting Area	Stonington	Interim		X					
American Velvet Co.	Stonington	Addendum		X	X				
Stonington Hbr. Breakwater	Stonington	Addendum		X				X	
Harley Farm Reserve	Groton	Interim		X					
Buff Point Reserve	Groton	Interim		X			X		
Trumbull Airport	Groton	Interim		X			X		
U.S. Coast Guard Sta.	Groton	Interim		X			X		
Black Ledge	Groton		Town						X
Pfizer Chemical Co.	Groton	Addendum		X					
Hess Oil	Groton	Addendum				X	X		
Groton WWT Facility	Groton	Addendum		X			X		
Gold Star Bridge	New London		State						X
Trumbull St. WWT	New London	Addendum				X	X		
U.S. Coast Guard Academy	New London	Interim							X
City Coal Co. & Central VT R.R.	New London	Addendum					X		
Ft. Trumbull USN Res.	New London	Interim					X		
Riverside WWT Facility	New London	Addendum				X	X		
Harkness Memorial Park	Waterford	Interim		X	X				
Bartlett Reef	Waterford	Is./Shoal		X					
State Sanitarium	Waterford	Interim			X				
Twotree Island	Waterford		Public Int.			X		X	
Millstone Nuclear Power Plant	Waterford	Addendum		X					
State Military Camp	East Lyme	Interim		X			X		
Rocky Neck State Park	East Lyme	Interim		X			X		
Griswold Point	Old Lyme	Addendum		X		X			
Great Is. Fish & Wildlife Area	Old Lyme	Interim		X					
Great Island	Old Lyme	Addendum				X			
Lyme Station Tidal Flat	Old Lyme	Addendum		X		X			
Calves Island	Old Lyme	Interim		X		X			
Lord Cove Fish & Wildlife Area	Lyme	Interim		X					
Brockway, CT River	Essex	Interim		X			X		
Notts Island	Lyme	Interim		X			X		
CT River, Saybrook Jetty	Old Saybrook	Addendum		X					
Rock Creek, North	Old Saybrook	Addendum		X	X	X			
Rock Creek, South	Old Saybrook	Addendum				X			
Old Saybrook Sand & Gravel	Old Saybrook	Addendum					X		
Menunketesuck Island	Westbrook	Is./Shoal							X
Duck Is. Hbr. Breakwater	Westbrook	Addendum							X
Duck Is. Roads	Westbrook/Clinton	Is./Shoal							X
Six Mile Reef	Clinton	Is./Shoal		X					
Clinton Hbr. Breakwaters	Clinton	Addendum				X			
Clinton Hbr., East	Clinton	Addendum		X					
Clinton Land Disposal	Clinton	Interim		X					
Clinton Harbor	Clinton	Addendum	Business						X
Cedar Island Flats	Clinton	Addendum		X					
[illegible]	[illegible]	[illegible]		X					

Six Mile Reef	Clinton	Is./Shoal		X					
Clinton Hbr. Breakwaters	Clinton	Addendum				X			
Clinton Hbr., East	Clinton	Addendum		X					
Clinton Land Disposal	Clinton	Interim		X					
Clinton Harbor	Clinton	Addendum	Business						X
Cedar Island Flats	Clinton	Addendum		X					
Hammonasset River Flats	Clinton	Addendum		X					
Hammonasset State Park	Madison	Interim		X					
Madison Golf Course	Madison	Interim			X				
East River Fish & Wildlife Area	Madison	Interim		X					
Grass Island	Guilford	Addendum	Town						X
Falkner Island	Guilford	Is./Shoal							X
Guilford Harbor West	Guilford	Addendum		X	X				
Yacht Club	Guilford		Town						X
Cockaponset State Park	Guilford	Interim					X		
Thimble Is. Stony Creek	Branford	Is./Shoal		X	X				
Wastewater Treatment Plant	Branford	Addendum		X			X		
Indian Neck	Branford	Addendum		X			X		
Branford River Disposal	Branford	Interim		X					
Atlantic Wire Co.	Branford	Addendum					X		
Kelsey Island	Branford	Addendum		X					
East Rock Park	New Haven	Interim					X		
East Side WWT	New Haven	Addendum					X		
English Power Station	New Haven	Addendum					X		
Arco, Exxon, Getty, Etc.	New Haven	Addendum					X		
Nathan Hale Park	New Haven	Interim		X					
East Shore Park	New Haven	Interim		X					
Quinnipiac Park	New Haven	Interim					X		
Bayview Park	New Haven	Interim		X					
Morris Cove "Hole"	New Haven		State						X
East Street WWT	New Haven	Addendum					X		
Lighthouse Point Park	New Haven	Interim		X					
New Haven Harbor Breakwaters	New Haven	Addendum		X					
Sargent & Co.	New Haven	Addendum		X					
Sandy Point	West Haven		Town						X
New Haven Harbor Breakwaters	New Haven	Addendum		X					
New Haven Blvd. WWT	New Haven	Addendum		X					
West River Land Disposal	West Haven	Interim	Town	X					X
West Haven WWT	West Haven	Addendum							X
Prospect Beach Hole	West Haven		State						X
Morse Park	West Haven	Interim		X	X		X		
CT Refining Co.	New Haven	Addendum		X					
Elm City Plant No. 3	New Haven	Addendum		X					
Woodmont Shores Groins	Milford	Addendum			X				
Gulf Pond WWT	Milford	Addendum		X			X		
Schick Safety Razor	Milford	Addendum		X			X		
Ft. Trumbull Beach	Milford		Town						X
Silversands State Park	Milford	Interim			X				
Housatonic River Breakwaters	Milford	Addendum				X		X	
Laurel Beach "Hole"	Milford		State						X
Wheeler Fish & Wildlife Area	Milford	Interim		X					X
Milford Point	Milford		Individual						
Stratford Shoal	Stratford	Is./Shoal							X
U.S. Coast Guard Station	Stratford	Interim		X					
Devon Power Station	Milford	Addendum		X			X		
Short Beach	Stratford	Interim			X				
Lordship Beach & Park	Stratford	Interim			X				
Arco: Lycoming	Stratford	Addendum		X			X		
Bridgeport Airport Disposal	Stratford	Interim		X					
Stratford WWT	Stratford	Addendum				X			
Sun Oil Company	Bridgeport/Stratford	Addendum		X					
Pleasure & Long Beach	Bridgeport/Stratford	Interim			X				
Carpenter Tech. Co.	Bridgeport	Addendum					X		
East Side WWT	Bridgeport	Addendum					X		
Yellow Mill Channel	Bridgeport		Town						X
Steel Point Power Station	Bridgeport	Addendum		X			X		
Remington Electric	Bridgeport	Addendum					X		
Seaside Park	Bridgeport	Interim			X				
Bridgeport Hbr. Power Station	Bridgeport	Addendum		X			X		
West Side WWT	Bridgeport	Addendum		X		X			
[illegible]	Bridgeport	Addendum		X					

[illegible]	[illegible]		State						X
Morse Park	West Haven	Interim		X	X		X		
CT Refining Co.	New Haven	Addendum		X					
Elm City Plant No. 3	New Haven	Addendum		X					
Woodmont Shores Groins	Milford	Addendum			X				
Gulf Pond WWT	Milford	Addendum		X			X		
Schick Safety Razor	Milford	Addendum		X			X		
Ft. Trumbull Beach	Milford		Town						X
Silversands State Park	Milford	Interim			X				
Housatonic River Breakwaters	Milford	Addendum				X		X	
Laurel Beach "Hole"	Milford		State						X
Wheeler Fish & Wildlife Area	Milford	Interim		X					X
Milford Point	Milford		Individual						
Stratford Shoal	Stratford	Is./Shoal							X
U.S. Coast Guard Station	Stratford	Interim		X					
Devon Power Station	Milford	Addendum		X			X		
Short Beach	Stratford	Interim			X				
Lordship Beach & Park	Stratford	Interim			X				
Arco: Lycoming	Stratford	Addendum		X			X		
Bridgeport Airport Disposal	Stratford	Interim		X					
Stratford WWT	Stratford	Addendum				X			
Sun Oil Company	Bridgeport/Stratford	Addendum		X					
Pleasure & Long Beach	Bridgeport/Stratford	Interim			X				
Carpenter Tech. Co.	Bridgeport	Addendum					X		
East Side WWT	Bridgeport	Addendum					X		
Yellow Mill Channel	Bridgeport		Town						X
Steel Point Power Station	Bridgeport	Addendum		X			X		
Remington Electric	Bridgeport	Addendum					X		
Seaside Park	Bridgeport	Interim			X				
Bridgeport Hbr. Power Station	Bridgeport	Addendum		X			X		
West Side WWT	Bridgeport	Addendum		X		X			
Bridgeport Hbr. Breakwaters	Bridgeport	Addendum		X					
Black Rock Harbor	Bridgeport		State	X					
Penfield Shoals	Fairfield		Town						X
Black Rock Harbor Breakwater	Bridgeport	Addendum		X					
Jenning Beach & Park	Fairfield	Interim			X				
Southport Harbor Breakwater	Fairfield	Addendum		X	X				
Sherwood Island "Hole"	Westport		State						X
Sherwood Island State Park	Westport	Interim		X	X				
Westport Longshore Club Park	Westport	Interim		X					
Parker Harding	Westport		Business				X	X	
East Norwalk City Park	Norwalk	Interim		X	X				
Norwalk Islands	Norwalk	Is./Shoal		X					
Harborview	Norwalk	Addendum				X		X	
Norwalk Harbor Power Station	Norwalk	Addendum				X		X	
Norwalk WWT	Norwalk	Addendum					X		
Seaview Park	Norwalk	Interim			X		X		
Penn Petroleum Co.	Norwalk	Addendum						X	
South Norwalk Power Station	Norwalk	Addendum					X		
Hoyt Island	Norwalk	Addendum				X		X	
Norwalk Memorial Park	Norwalk	Interim					X		
Darien WWT	Darien	Addendum				X	X	X	
Cove Island Park	Stamford	Interim		X	X				
Cove Island Jetty	Stamford	Addendum		X	X				
Cummings Park	Stamford	Interim					X		
Stamford WWT	Stamford	Addendum					X		
Dyke Park	Stamford	Interim					X		
Stamford Harbor Breakwater	Stamford	Addendum		X					
Southfield Park	Stamford	Interim					X		
Fleming Rutledge Oil	Stamford	Addendum		X			X		
Electrolux	Greenwich	Addendum					X		
Greenwich Point Park	Greenwich	Interim		X					
Captain's Harbor	Greenwich	Is./Shoal							X
Cos Cob Power Station	Greenwich	Addendum						X	
Bruce Park	Greenwich	Interim		X					
Greenwich Park	Greenwich	Interim		X			X		
Greenwich WWT	Greenwich	Addendum				X		X	
Byram Park	Greenwich	Interim					X		
Port Chester Hbr. Breakwaters	Greenwich/Rye, N.Y.	Addendum				X		X	

TABLE V-15
INTERMEDIATE SITES CONSIDERED
NEW YORK

SITE	CITY OR TOWN	RECOMMENDED BY: REPORT	LOCAL REQUEST	REASON FOR REJECTION: ENVIRONMENTAL	SOCIAL	COST	SIZE	DISTANCE TO DREDGING	WARRANTS FURTHER EVALUATION
Manursing Island Park	Rye	Interim			X				
Milton Town Park	Rye	Interim		X					
Scotch Caps	Rye		Business	X					
Crab Island/Black Tom	Mamaroneck		Business						X
Harbor Island Park	Mamaroneck	Interim				X	X		
Wastewater Treatment Plant	Mamaroneck	Addendum					X		
Larchmont Hbr. Breakwaters	Mamaroneck	Addendum						X	
Flint Park	Mamaroneck	Interim					X		
Echo Bay Breakwaters	Mamaroneck	Addendum						X	
Wastewater Treatment Plant	New Rochelle	Addendum					X		
David's Island	New Rochelle		Business						X
Sun Oil Co.	New Rochelle	Addendum					X		
Hudson Park	New Rochelle	Interim		X			X		
New Rochelle Hbr. Breakwaters	New Rochelle	Addendum						X	
U.S. Military Reservation	New York	Interim				X			
Hart Island WWT	New York	Addendum					X		
Pelham Bay Park	New York	Interim			X				
Pelham Bay Park Disposal Area	New York	Interim							X
NY Merchant Marine Academy	New York	Interim					X		
U.S. Naval Reservation	New York	Interim				X			
Ferry Point Park	New York	Interim			X				
Castle Hill Point Park	New York	Interim					X		
Sound View Park	New York	Interim					X		
LaGuardia Airport, Flushing Bay	New York	Addendum	City						X
College Pt. Shorefront Pk	New York	Interim					X		
Tall Man Island WWT	New York	Addendum					X		
Little Bay Park	New York	Interim			X				
Fort Totten Military Res.	New York	Interim		X					
Golden & Crocheron Park	New York	Interim		X					
Alley Park	New York	Interim		X			X		
Little Neck WWT	North Hempstead	Addendum				X			
Great Neck Estates Park	North Hempstead	Interim		X			X		
Grist Mill Pond Park & Museum	North Hempstead	Interim					X		
U.S. Merchant Marines Academy	North Hempstead	Interim		X					
Stepping Stone Park	North Hempstead	Interim			X				
Great Neck (v) WWT	North Hempstead	Addendum		X			X		
Metropolitan Petroleum, Etc.	North Hempstead	Addendum					X		
Great Neck	North Hempstead	Addendum		X			X		
Manhasset Valley Park	North Hempstead	Interim		X					
Leed Pond Park	North Hempstead	Interim		X			X		
Sunset Park	North Hempstead	Interim		X					
Manhasset Bay Public Dock	North Hempstead	Interim		X					
Port Washington WWT	North Hempstead	Addendum		X	X		X		
Manor Haven Park	North Hempstead	Interim		X			X		
Sands Pt. County Pk & Pres.	North Hempstead	Interim		X					
U.S. Naval Reservation	North Hempstead	Interim		X					
[illegible]	North Hempstead	Addendum		X					

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Sands Pt. County Pk & Pres.	North Hempstead	Interim		X				
U.S. Naval Reservation	North Hempstead	Interim		X				
Colonial Sand & Gravel	North Hempstead	Addendum		X				
Hempstead Hbr. Park	North Hempstead	Interim	County	X				
Roslyn WWT	North Hempstead	Addendum					X	
Auto East, Mobile & Lewis Oil	North Hempstead	Addendum					X	
Phillips Oil	North Hempstead	Addendum					X	
Windsor Oil	North Hempstead	Addendum					X	
Glenwood Power Station	North Hempstead	Addendum			X		X	
Tappen Beach	Oyster Bay	Interim			X			
Tappen Beach Disposal Area	Oyster Bay	Interim					X	
Glen Cove Disposal Area	Glen Cove	Interim					X	
Glen Cove WWT	Glen Cove	Addendum					X	
Long Island Tungsten-Metal	Glen Cove	Addendum					X	
Powers Chemco Inc.	Glen Cove	Addendum					X	
Garvies Point Park	Glen Cove	Interim					X	
Garvies Point Preserve	Glen Cove	Interim					X	
Morgan Memorial Park	Glen Cove	Interim			X		X	
Hempstead Hbr. Breakwaters	Glen Cove	Addendum				X		
Glen Cove City Park	Glen Cove	Interim		X	X			
Mill Neck Preserve	Oyster Bay	Interim		X				
Bayville Park	Oyster Bay	Interim		X				
Roosevelt Memorial Park	Oyster Bay	Interim		X				
Oyster Bay WWT	Oyster Bay	Addendum					X	
Commander Oil Co.	Oyster Bay	Addendum		X			X	
Centre Island (North)	Oyster Bay	Addendum					X	X
Centre Island (East)	Oyster Bay	Addendum					X	X
Sagamore Hill Historic Site	Oyster Bay	Interim		X	X			
Mobile Oil Co.	Huntington	Addendum				X	X	
Lloyd Hbr. Village Park	Huntington	Interim		X				
Caumsett State Park	Huntington	Interim		X	X			
Huntington Utilities	Huntington	Addendum						X
Huntington Hbr. Sand & Gravel	Huntington	Addendum					X	
Mill Dam View Park	Huntington	Interim					X	X
Huntington WWT	Huntington	Addendum					X	
West Beach	Huntington	Interim			X			
U.S. Coast Guard Station	Huntington	Interim		X				
Mill Pond Land Disposal	Huntington	Interim		X				
Vanderbilt Museum	Huntington	Interim		X	X			
Northport Hbr. Land Dispoal	Huntington	Interim		X				
Northport WWT	Huntington	Interim		X				
Steers Sand & Gravel	Huntington	Interim		X				
Asharoken Beach Disposal	Huntington	Interim		X				
Northport Power Station	Huntington	Addendum					X	
Crab Meadow Beach and Park	Huntington	Interim			X			
Sunken Meadow Park Disposal	Smithtown	Interim		X				
Sunken Meadow State Park	Smithtown	Interim		X	X			
San Remo WWT	Smithtown	Addendum		X			X	
Short Beach Town Park	Smithtown	Interim			X			
Nissequogue Golf Course	Riverhead	Interim		X				
Nissequogue River Disposal	Riverhead	Interim		X				
Long Beach	Riverhead	Interim			X			
Porpoise Channel	Riverhead	Interim		X				
West Meadow Beach	Riverhead	Interim			X			
Old Field Beach	Riverhead	Interim			X			
Port Jefferson Power Station	Riverhead	Addendum					X	
Port Jefferson WWT	Riverhead	Addendum					X	
Swezy Oil, Exxon, Etc.	Riverhead	Addendum						X
Mt. Misery Pt. Disposal	Riverhead	Interim		X				
Port Jefferson Hbr. Jetties	Riverhead	Addendum						X
Mt. Misery Pt.	Riverhead	Interim		X				
White Beach	Riverhead	Interim			X			
Mt. Sinai Harbor Jetties	Riverhead	Addendum			X		X	
Cedar Beach	Riverhead	Interim			X			
Wading River Land Disposal	Riverhead	Interim		X				
Shoreham Power Station	Brookhaven	Addendum		X			X	
Wildwood State Park	Riverhead	Interim		X	X			
H.M. Reeve Park	Riverhead	Interim		X	X			
Northville Industries	Riverhead	Addendum					X	
Jamesport LILCO	Riverhead	Addendum						X
[illegible]	[illegible]	[illegible]			X			

Centre Island (East)	Oyster Bay	Addendum				X	X
Sagamore Hill Historic Site	Oyster Bay	Interim	X	X			
Mobile Oil Co.	Huntington	Addendum			X	X	
Lloyd Hbr. Village Park	Huntington	Interim	X				
Caumsett State Park	Huntington	Interim	X	X			
Huntington Utilities	Huntington	Addendum					X
Huntington Hbr. Sand & Gravel	Huntington	Addendum				X	
Mill Dam View Park	Huntington	Interim				X	X
Huntington WWT	Huntington	Addendum				X	
West Beach	Huntington	Interim		X			
U.S. Coast Guard Station	Huntington	Interim	X				
Mill Pond Land Disposal	Huntington	Interim	X				
Vanderbilt Museum	Huntington	Interim	X	X			
Northport Hbr. Land Dispoal	Huntington	Interim	X				
Northport WWT	Huntington	Interim	X				
Steers Sand & Gravel	Huntington	Interim	X				
Asharoken Beach Disposal	Huntington	Interim	X				
Northport Power Station	Huntington	Addendum				X	
Crab Meadow Beach and Park	Huntington	Interim		X			
Sunken Meadow Park Disposal	Smithtown	Interim	X				
Sunken Meadow State Park	Smithtown	Interim	X	X			
San Remo WWT	Smithtown	Addendum	X			X	
Short Beach Town Park	Smithtown	Interim		X			
Nissequogue Golf Course	Riverhead	Interim	X				
Nissequogue River Disposal	Riverhead	Interim	X				
Long Beach	Riverhead	Interim		X			
Porpoise Channel	Riverhead	Interim	X				
West Meadow Beach	Riverhead	Interim		X			
Old Field Beach	Riverhead	Interim		X			
Port Jefferson Power Station	Riverhead	Addendum				X	
Port Jefferson WWT	Riverhead	Addendum				X	
Swezy Oil, Exxon, Etc.	Riverhead	Addendum					X
Mt. Misery Pt. Disposal	Riverhead	Interim	X				
Port Jefferson Hbr. Jetties	Riverhead	Addendum					X
Mt. Misery Pt.	Riverhead	Interim	X				
White Beach	Riverhead	Interim		X			
Mt. Sinai Harbor Jetties	Riverhead	Addendum		X		X	
Cedar Beach	Riverhead	Interim		X			
Wading River Land Disposal	Riverhead	Interim	X				
Shoreham Power Station	Brookhaven	Addendum	X			X	
Wildwood State Park	Riverhead	Interim	X	X			
H.M. Reeve Park	Riverhead	Interim	X	X			
Northville Industries	Riverhead	Addendum				X	
Jamesport LILCO	Riverhead	Addendum					X
Public Beach	Riverhead	Interim		X			
Petroleum Facility	Southold	Addendum				X	
Mattituck Inlet Park	Southold	Interim	X				
Mattituck Hbr. Jetties	Southold	Addendum		X			
Mattituck In. Land Disposal	Southold	Interim		X			
Goldsmith Inlet Park	Southold	Interim	X				X
Great Pond County Park	Southold	Interim	X				X
Horton Neck Park & Museum	Southold	Interim	X	X			
Southold Power Station	Southold	Addendum				X	
Greenport Park	Southold	Interim	X				X
E. Marion Orient Park	Southold	Interim					X
Orient Beach State Park	Southold	Interim					X
Fisher Island	Fishers Island	Addendum	X			X	
U.S. Coast Guard Station	Fishers Island	Interim			X		

3

COORDINATION AND PUBLIC INVOLVEMENT

Brochure

The formal public involvement program essentially began with the dissemination of a public information brochure to approximately 2,500 State and local officials, newspapers, radio and television stations, commercial and industrial interests, public interest groups and individuals. This brochure entitled, "Long Island Sound Dredging and Disposal: The Search for a Solution"[1] was designed to increase the public's awareness and understanding of the containment concept, one of several dredged material disposal alternatives. The nature of the study, the issues and problems associated with containment, the unique Long Island Sound ecosystem, the characteristics of dredged material, the site selection criteria and the planning process were also explained in the brochure. The brochure is included as Figure V-23.

Workshops

A series of four public workshops were held 18-21 May 1981 to enable us to expand on the information supplied in the brochure. The public workshop notice shown as Figure V-24 lists the times and locations of each meeting. Meeting announcements were sent to the same groups and individuals who received the brochure and were also extensively publicized by the newspapers and local radio stations. All four meetings were well attended with approximately 60 people each. A wide range of interests and knowledge of the subject were represented. A slide presentation illustrating the concept of dredged material containment and existing containment sites located throughout the country was the focal point of each meeting. Also, potential environmental concerns were discussed prior to beginning an open discussion period.

Digest

The Long Island Sound Taskforce the regional chapter of the Oceanic Society, served as moderators at each of the workshops. A Workshop Digest prepared by the Taskforce is a summary of the proceedings and particularly the open discussion (question and answer) sessions. This digest is a complete record of the workshops including all public announcements, press releases and meeting notices distributed in conjunction with these workshops. A primary purpose of the Workshop Digest was to enable those people who were interested but unable to attend the workshop to be kept informed of the issues and questions raised concerning containment. The digest was sent to all workshop participants and anyone who requested it.

[1]Prepared by Jason Cortell Associates under contract to the New England Division.

A substantial amount of interest was displayed by the residents of the study area. During the meetings and the following weeks we received letters in support of the study and the concept of dredged material containment. Some of these letters suggested potential sites for the prototype studies of a containment facility and a salt marsh creation project. Although some apprehension concerning containment was evident at the meetings, all the letters we have received are extremely positive and imply that this alternative needs to be investigated.

During the discussion period of each meeting the audience was asked for their comments or questions concerning containment facilities and although some people were skeptical at first, most were interested in learning more about the details of costs and site locations. Specific costs of the dikes, disposal, and hydraulic dredging were the major issues at the New London meeting. Other questions raised at those meetings included topics such as how to avoid harming the oyster beds and how to ensure that the contaminants don't leach out. Comments and questions resulting from these meetings are reviewed in the Workshop Digest.

October '81 Update

In October 1981, a public information update was distributed to approximately 2000 people and groups who had previously received the Spring '81 brochure. The progress report/update was intended to serve as a follow-up to the brochure and the workshop meetings held in May. This update shown as Figure V-25 included a brief summary of the work items recently completed or underway at that time. The various analysis and screenings being conducted and the reports which were completed or being written were each explained in 1 or 2 paragraphs each to show study participants what was being done to resolve the unanswered questions resulting from the workshops. It also provided an opportunity to show study participants the extent of data and amount of detail required to conduct a study and plan a project of this magnitude.

Island/Shoal Screening

In conjunction with the Island/Shoal Screening performed by the Oceanic Society, under contract to the Corps of Engineers, a letter was sent to local officials and concerned individuals requesting assistance in acquiring information on ten specified areas along the Connecticut coast. This letter, shown as Figure V-26, was distributed in January 1982 along with a corresponding press release.

Autumn '82 Update

The Autumn 1982 Public Information Update was similar to the '81 Update. It reported briefly the reports and activities which had been completed since the '81 Update. This most recent update is shown as Figure V-27.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF

NEDPL-BC

28 December 1980

As you may be aware, we are conducting a study to determine the feasibility of creating dredged material containment facilities for the Long Island Sound area. This study was originally authorized by Connecticut Representatives Giaimo, McKinney, and Dodd.

A preliminary report describing the existing and projected future conditions relating to dredging activities in Connecticut harbors was prepared in January 1979. This report, called a reconnaissance report, was approved by the Office of the Chief of Engineers in Washington, DC with the condition that the study be expanded to include the New York waters of Long Island Sound.

Since that time, we have been acquiring the required preliminary data on dredging projections and overall needs for New York, as well as initiating preliminary site screening analysis of potential containment facilities throughout Long Island Sound. The screening analysis performed to date has been limited to publicly owned lands and represents evaluations made by a consulting firm.

The attached report, dated July 1980, documents the above work and includes other information such as general design criteria for containment structures and recommended future study efforts. Copies of this report have previously been sent to various State agencies in New York and Connecticut, as well as some regional planning groups and other Federal agencies for comment.

We have had several meetings recently with the Coastal Area Management Office of the Connecticut Department of Environmental Protection, and the Long Island Sound Taskforce to discuss all phases of this study. The general comment most often mentioned regarding the report is that some potential containment sites may have been either evaluated incorrectly or omitted from the analysis. Re-analysis of some of the sites listed in the report is presently being done based upon a different set of criteria.

FIGURE V-22

NEDPL-BC

Some potential sites worthy of analysis have been suggested to us by the above two groups, and these will be studied. However, the best source of information regarding other potential sites is at the local level. If you or other members of your community are aware of any potential sites, regardless of location, please advise us as soon as possible. It should be reiterated that we are seeking potential candidate sites for detailed evaluations, which would include environmental and physical analysis. Any decisions on where to recommend potential containment sites will only be made after detailed evaluations and extensive coordination with State, regional and local interests.

We are also presently trying to involve municipalities and local interest groups in the overall study effort. Public workshops will be scheduled throughout the Long Island Sound area beginning in early 1981. However, prior to these workshops we would like to meet with local officials so that more of their ideas and comments would be available to us for use at these workshops. If either you or other municipal officials wish to meet with us to discuss the study, have any comments on the report, desire more information, or know of any potential containment sites, please contact the study manager, Mr. Richard Quinn (617-894-2400, extension 215) at the above address.

Sincerely,

Joseph L. Ignazio

Incl
As stated

JOSEPH L. IGNAZIO
Chief, Planning Division

US Army Corps of Engineers
New England Division

LONG ISLAND SOUND

DREDGING AND DISPOSAL THE SEARCH FOR A SOLUTION

DREDGED MATERIAL CONTAINMENT

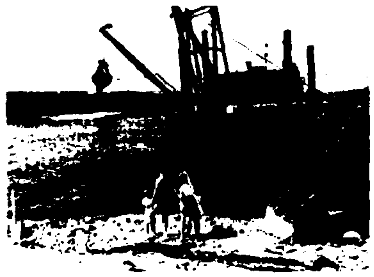
WHY CONTAINMENT ?

Long Island Sound is important to both recreational boaters and commercial ship traffic. Yet in recent years, dredging in Long Island Sound has not kept pace with the accumulation of sediments in the many harbors and estuaries. It has become difficult to carry out needed dredging projects because of growing resistance to traditional ways of disposing of dredged material, i.e., dumping at designated open water sites in the Sound.

In response, the Corps of Engineers is seeking new approaches for coping with the Long Island Sound dredging problem. This brochure represents one feature of the Corps program.* It is being distributed prior to a series of public workshops. We encourage you to attend a Workshop and participate in formulating policy for dredging and disposal which will ensure a clean, healthy, and navigable Long Island Sound for many years to come.

One alternative receiving serious consideration for Long Island Sound is the possibility of constructing several enclosed containment areas large enough to receive the Sound's contaminated dredged material over a period of several decades. Focus on the containment alternative began with a Resolution adopted on May 10, 1977, by the Committee on Public Works and Transportation of the U.S. House of Representatives. The Resolution called upon the U.S. Army Corps of Engineers to determine the feasibility and impacts of creating several artificial islands or diked shoreline extensions to accommodate dredged material in Long Island Sound. The Resolution also instructed the Corps to investigate possibilities of using these containment facilities for marsh building, recreation, resource recovery, and solid waste disposal.

This brochure has two objectives: (1) to inform the states, public officials, other Federal agencies, and the public about the problems of dredged material disposal in Long



Island Sound; and (2) to encourage your participation in an examination of the containment or artificial island alternative as at least a partial solution to the disposal problem in Long Island Sound.

The brochure is structured to supply the basic information you will need in considering the disposal problem and in assessing the merits and shortcomings of contained disposal. Background information will assist in putting the problem and proposed solutions in perspective. A discussion of Long Island Sound as an ecosystem will help you see the Sound as a viable, and somewhat fragile, living entity subject to man's effluents and disruptive intrusions.

There is a discussion of the historical perspective of dredging in the Sound, and from this review, projections of dredging and disposal requirements are developed. Physical, chemical, and biological characteristics of sediments are discussed and the means explored in detail by which contaminants enter and then are concentrated in sediments. Pertinent Corps planning and site-selection procedures are related to the overall study and planning process, and there is a treatment of the relationship of containment and dredging in general to policy issues and special areas of concern. The brochure concludes with additional specific information about Federal, State, and public participation in this search for disposal alternatives in Long Island Sound.

WHAT IS CONTAINMENT DISPOSAL?

Dredged material containment facilities usually consist of large shallow basins, surrounded by structured dikes. Dredged material is placed in these basins and sediment is allowed to 'e out while the water is grac 'rawn off through weirs or pipi stems. Material is often placed ntainment structures when it e retained at a specific locat and (1) large volumes of dred aterial are removed fr '2) hydraulic dredging req aration of water and sediment, the containment structure is used as a settling basin; (3) where local topography (extensive flat, shallow areas) facilitates construction of dike systems; and (4) extension of land areas or establishment of artificial islands is desired.

Recently, concern about contamination of some dredged materials has focused new attention on containment as a means of protecting marine life from the pollution which can result from open water disposal. Containment has been proposed as a solution to the problem of disposing large volumes of contaminated material dredged in Long Island Sound. Containment will retain water-sediment slurries until the particulate material settles, permitting controlled release of the water as it becomes clean. Contaminants remain primarily with the sediments and are not discharged in the water. Holding polluted sediments in the containment basins minimizes opportunities for marine flora and fauna to collect, retain, and accumulate contaminants. This lessens the chances of damage to the Sound's environment. Containment facilities can be large enough to serve a region, thus reducing the number of disposal areas required.

Three types of containment basins have been considered for Long Island Sound: (1) very large diked

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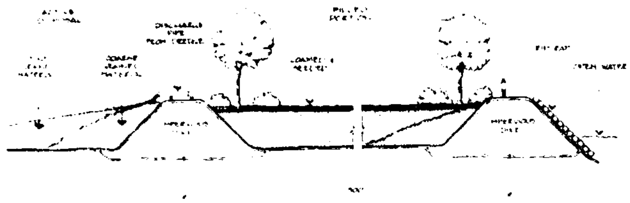
A series of Public Workshops is being planned You are invited to attend see page 11 for Details

Figure V-23

DREDGED MATERIAL CONTAINMENT



CONCEPTUAL DIAGRAM OF A
DREDGED MATERIAL CONTAINMENT AREA

WHAT IS CONTAINMENT DISPOSAL (CONT.)

structures located away from shore in deeper portions of the Sound; (2) large or medium-size containment facilities located in shallow waters closer to shore but separated from shore; and (3) large or small structures located along and attached to shorelines. Containment basins not attached to the coast might be filled and become artificial islands, while shoreline projects could create new tidal wetlands. Other uses proposed for containment structures or artificial islands include wildlife habitats, special oceanside light industry or cargo handling areas, and resource recovery centers. Not a new approach, this disposal alternative has been used successfully in the Great Lakes, South Atlantic, and Gulf Coastal states.

Structural features of containment basins include dikes, weirs or sluiceways, baffles or spur dikes to slow water flow and enhance sediment settling, and sectional dikes separating the facility into subbasins. Exterior walls of the main dikes are equipped with rip-rap to prevent wave action erosion. Specialized facilities may have other features.

WORKING TOGETHER TO IMPROVE LONG ISLAND SOUND

Many interested parties have focused their attention on the Sound in recent years. Some of the regional efforts to develop guidelines and management programs are noted below.

STATE PROGRAMS

New York - Connecticut Interim Disposal Management Program: During the early 1970s, New York and Connecticut became parties to certain legal actions growing out of increased concerns about impacts from open disposal of dredged material. One of the outcomes of these actions was an arrangement between the States entitled the Joint Interim Dredging Disposal Management Plan. The focus of the Plan is on open water disposal and provides a structure for incorporating pertinent responsibilities at all levels of government. The term "interim" is important; the Program is designed as a joint management mechanism for use until a long-range plan is developed and implemented. New York and Connecticut view the Interim Management Plan as complementing Corps regulatory responsibilities and State Water Quality Certification processes.

Coastal Zone Management Programs and Other State Level Activities: The Federal Coastal Zone Management Act of 1972 requires that all Federal agencies conducting, supporting, or licensing activities directly affecting coastal management act in a manner consistent with each affected State's program.

Connecticut has a Coastal Zone Management program within its Department of Environmental Protection as the Planning and Coordination/Coastal Management Unit. Corps officials confer with this office and exchange information whenever pertinent matters are at hand. A similar arrangement exists with the Long Island Sound Task Force of the Oceanic Society, a non-governmental organization headquartered in Connecticut. The New York State Coastal Zone Management Program operates within the Office of Coastal Affairs section of the New York Department of State. Information is channeled principally through the New York Department of Environmental Conservation (DEC) which, in turn, works closely with the Office of Coastal Affairs.

Interim Plan for Disposal of Dredged Material from Long Island Sound: This report was issued by the New England River Basins Commission (NERBC) in August, 1980, addressing the short term problem of disposal in Long Island Sound. Another NERBC report will soon be issued entitled "Interim Plan for Land Disposal of Dredged Material," addressing another aspect of the overall disposal problem.

CORPS OF ENGINEERS PROGRAMS

Under authority of the present Resolution and other directives, the Corps of Engineers has carried out several studies directed at solutions to the Long Island Sound disposal problem.

Reconnaissance Report: Dredged Material Containment in Long Island Sound: This 1979 report focused on Connecticut waters and investigated the feasibility of large containment facilities or artificial islands as (a) nearshore land extensions, (b) shallow water islands, and (c) deep water islands within the Sound. Investigators concluded that the fine-grained nature of Connecticut sediments earmarked for dredging significantly limited the feasibility of large artificial islands except where dewatering equipment could be installed to speed up water removal. The study indicated that large volume containment structures *are probably feasible only as* longshore land extensions.

Interim Report: Dredged Material Containment in Long Island Sound - With Special Emphasis on Eastern New York Waters: This study concluded Stage 1 planning by examining the New York shoreline of Long Island Sound. The report also performed some Stage 2 planning by reviewing problems posed by all disposal alternatives and began development of guidelines for selection of potentially suitable locations for shoreline extension containment centers.

Programmatic Environmental Impact Statement for the Disposal of Dredged Material in the Long Island Sound Region: This document, scheduled for release later in 1981, is being prepared by the U.S. Army Corps of Engineers as a result of litigation between the Corps of Engineers and the Natural Resources Defense Council et al., and the States of New York and Connecticut. It addresses generic impacts associated with a range of disposal alternatives and supplies basic information upon which future Environmental Impact Statements or Environmental Assessments can be developed for specific sites within the Sound. It is intended to reduce significantly the duplication usually intrinsic in separate, case-by-case

CONTINUED ON NEXT PAGE

• A PROGRESS REPORT AND REVIEW •

WORKING TOGETHER (CONT.)

considerations. Yet, use of the document will assure a complete and thorough survey of all impacts and alternatives.

MAJOR CORPS OF ENGINEERS PROPOSED IMPROVEMENT PROJECTS

Two major improvement dredging programs have been proposed by the Corps of Engineers for Long Island Sound. One is for improvement of New Haven Harbor; the other for similar improvement of Bridgeport Harbor. The scope of the two programs is sufficiently large to constitute a major proportion of the improvement dredging volumes projected for the Sound in the near future.

Navigation Improvements - New Haven Harbor: New Haven is an important New England port, one of the region's major petroleum off-loading sites. A number of alternatives have been examined for ways to maintain the area's importance as a terminal for residual fuels, distillates, and gasoline. The improvement program judged most practical and desirable calls for deepening the six miles of the main shipping canal to 41 feet and widening it to 500 feet. In addition, plans call for enlarging and deepening the Harbor's turning basins. This program will produce approximately 4.8 million cubic yards of dredged material. Several alternatives have been reviewed for disposal of this material, including open water disposal and containment in an area adjacent to the Harbor. This project could be a candidate situation for a prototype containment program.

Navigation Improvements - Bridgeport Harbor and Vicinity: Commercial, recreational interests, and State and local officials in the Bridgeport area have urged a substantial waterway improvement program, and a plan incorporating economically feasible components has been developed. Dredging is proposed in Ash Creek, Cedar and Burr Creek Anchorages, Black Rock Harbor Anchorages, the Turning Basin, and Union Street Dock area in the main Harbor and Johnsons River.

Total estimated volume for dredged material is approximately 3.1 million cubic yards. Disposal alternatives have been considered, including open water disposal and containment in or adjacent to Bridgeport Harbor. Improvement dredging proposed here also provides opportunities for examining the practicality of containment disposal.

LONG ISLAND SOUND AS AN ECOSYSTEM

An ecosystem is a recognizable unit, incorporating both living and non-living components and the functional relationships that hold the system together. Ecosystems have both physical and non-living components, organic or inorganic materials; a producer component of photosynthetic plants able to manufacture food from sunlight and inorganic substances; a consumer component, primarily animals deriving their nutrition by consuming plants and other animals; and a decomposer component consisting of bacteria and fungi, which break down plant and animal remains into the basic nutrients required by the producers.

There is a cyclic nature to ecosystems. Nutrients and nutrient-forming elements continually cycle within the system, primarily driven by energy from the sunlight utilized in photosynthesis. Few ecosystems are completely separate units, as they usually overlap or interact in varying degrees. Thus, there is almost always some exchange of nutrients and organisms among them.

Easily defined ecosystems have clearly recognizable boundaries such as those characteristic of lakes, islands, and forests. Although the east and west ends of Long Island Sound connect with the Atlantic Ocean, the Sound is still sufficiently distinct to permit viewing it as a discrete ecosystem.

Marine plants and animals residing in the Sound, although not unique, may constitute discrete populations separated to varying degrees from similar populations outside the Sound. Some species, particularly finfish, may visit the Sound only during certain months of the year. Others, plankton for example, may occur within the Sound only during certain seasons yet live out their short life span without leaving the region.

Considering that nutrient flow is necessary for maintenance of a healthy Long Island Sound ecosystem, man's actions can initiate changes which are eventually felt through the entire system. Dredging and dredged material disposal are human activities which can potentially affect the Long Island Sound ecosystem. Much of the material dredged represents the accumulation of urban and industrial growth and activity. Contaminants may accumulate in plants and animals to levels that are toxic when consumed by "upper level" consumers including man.

Attention has focused in recent years on ways of continuing necessary dredging while preventing or minimizing entry of harmful contaminants into the Sound's nutrient cycles and food chains. Artificial islands and other containment structures are possible solutions to this problem. Open water disposal of dredged material has been practiced in Long Island Sound for many years. Dumped material, settling to the bottom, covers and eliminates those bottom dwellers either attached or unable to move fast enough to avoid burial. This is probably not a significant impact because organisms quickly recolonize the area. More important, however, is the mobilization of contaminants. As the material falls through the water, a small portion is dissolved and swept away. Remaining mobilized contaminants stay within the dredged material and fall to the bottom.

Presently, marine life recolonizes the newly deposited sediment. Adults of some species take up residence, and newly hatched forms of other species come to rest on the material. Many of these organisms routinely seek their sustenance from the sediment around them. Inadvertently, they consume and concentrate harmful contaminants. Certain contaminants, such as DDT, mercury, and possibly some forms of PCBs, may magnify upward through successively higher levels of the food chain and create cause for concern. It is desirable, therefore, to develop ways of removing and disposing of contaminated dredged material while effectively preventing pollutants from entering food chains of the Long Island Sound ecosystem.

LONG ISLAND SOUND DREDGING PAST, PRESENT, AND FUTURE

Traditionally, two kinds of dredging have been identified in Long Island Sound. One is channel maintenance, commonly labeled operations and maintenance (O&M); the other, improvement dredging. Operations and maintenance is essentially the removal of material filling previously dredged channels and basins. Improvement dredging constitutes new work deepening and widening existing channels and basins or creating new channels and basins. Generally, material removed during O&M dredging is unconsolidated silt and fine substances. Improvement dredging may involve fine sands, clays, heavy gravel, and rock. Sometimes, bedrock must be blasted loose and removed. Contamination is usually restricted to the surface and near-surface layers.

Historical Perspective: Dredged materials and other wastes have been routinely discharged in Long Island Sound for over 100 years. Materials have usually been deposited simply by dumping in designated areas. Although many locations have been used in the past, only three sites, New Haven, Cornfield Shoal, and New London, remain open on an interim basis for carefully controlled disposal.

The quantity of improvement dredging and operations and maintenance dredging in Long Island Sound has varied from year to year. In New York waters, there were extensive improvement projects during the 1920s and 1930s. Most dredging came to a halt during World War II, but after the war extensive maintenance work brought most areas back to pre-war conditions. In Connecticut waters, a large improvement program was launched in the late 1940s. Since the early 1960s, there has been a reduction in improvement dredging in Connecticut and an increase in New York waters.

Although maintenance projects have outnumbered improvement authorizations in both states, volumes removed by improvement work have exceeded those from maintenance work. However, there has been no improvement work by the Corps of Engineers along the Connecticut shore since 1970, and only one improvement project has been undertaken in New York waters during the same period. Three factors probably contribute to this decrease: a reduced rate of shoreline development, increased concern about dredging and disposal impacts, and increased costs.

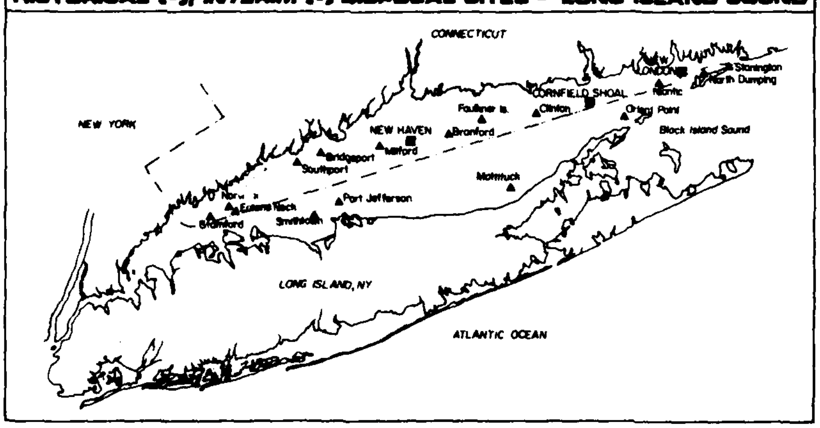
In addition to projects undertaken by the Corps of Engineers, the Corps issues permits for Federal, State, and local agencies and private parties to dredge in the Sound. Along New York shores, non-Corps dredging has historically produced volumes approximately equal to those removed by the Corps. In Connecticut, Corps-removed volumes have been several times larger than those produced by permit dredging. Upland and shore disposal sites were utilized in some instances. Thus, the entire volume indicated for any year was not necessarily deposited in the Sound. At present, there are 19 continuing authorized Federal projects in New York State waters of the Sound and 27 in Connecticut waters.

Projections: Developing projections for future dredging projects is necessary to estimate disposal requirements for the coming decades. New trends and policies are emerging. On Long Island, Nassau and Suffolk Counties have formulated new policies calling for scaling down of new dredging work by de-authorization of Federal programs in Manhasset Bay, Hempstead Harbor, Huntington Harbor, and Northport Harbor; and transfer of petroleum terminal activities to new offshore facilities in Hempstead and Port Jefferson Harbors. The new policies also call for consolidation of deep-draft vessel facilities in deeper areas such as Glen Cove Creek, Huntington Harbor, Port Jefferson, and Greenport Harbor. In contrast, the New York District, Corps of Engineers, is considering possible channel improvements in Echo Bay and New Rochelle Harbor in Westchester County.

Two major improvement proposals for Connecticut have been described in this booklet. These projects alone, if carried out as proposed, could produce nearly 8 million cubic yards of material. Other improvement projects have been discussed for Clinton, Patchogue River, and New London.

The Corps of Engineers has developed projections for dredging and dredged material volumes extending 50 years into the future, to approximately 2035. Several assumptions provide a basis for these projections. For maintenance dredging, it is assumed that silting will continue at present rates. If improvement dredging proceeds as anticipated, some additional maintenance programs will have to be

HISTORICAL (▲), INTERIM (■) DISPOSAL SITES – LONG ISLAND SOUND



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PAST, PRESENT AND FUTURE (CONT.)

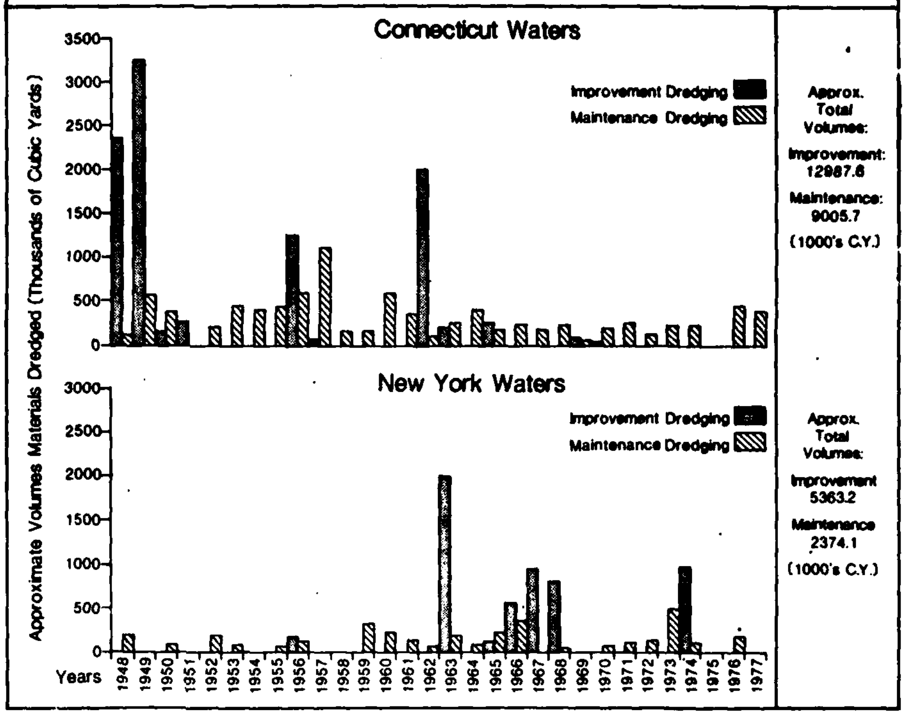
instituted to clear improved areas completed early in the projected term. Improvement dredging projections take into consideration work levels ranging from maintenance of the status quo (zero improvement dredging) to activation of all planned projects. Although not separated, non-Federal, Corps-authorized projects characteristically involve both maintenance and improvement dredging.

Dredging projections for New York waters are itemized in geographical subsections: (1) dredging in New York City in the East River; (2) dredging in New York City areas adjacent to the western end of Long Island Sound; (3) dredging in Westchester County; (4) dredging in Nassau County; and (5) dredging in Suffolk County. Dredging for East River areas has been included since Long Island Sound serves as a depository for dredged materials.

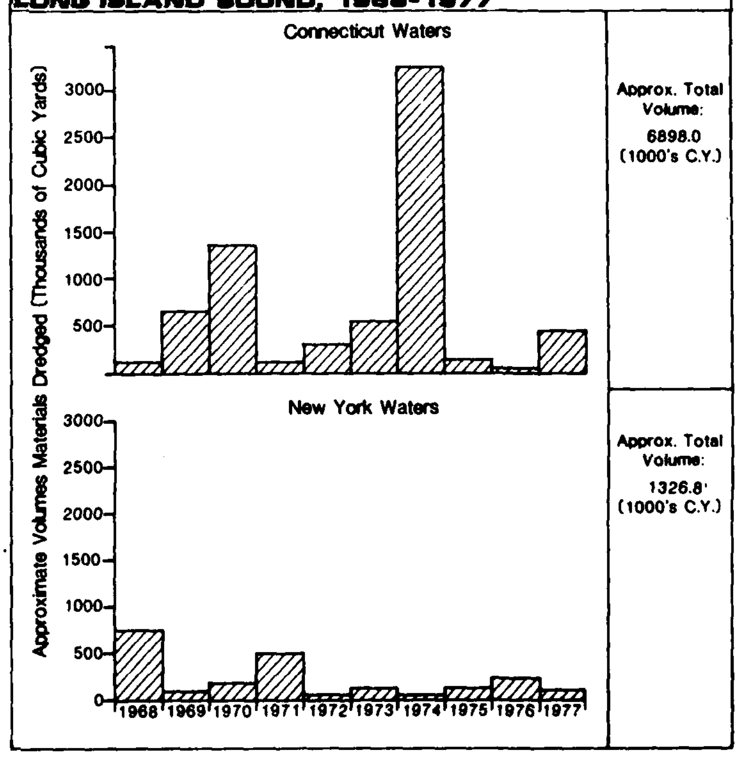
Projected dredging requirements in Connecticut are developed (non-Federal, Federal improvement, and Federal maintenance) for western, central, and eastern portions of the Sound. The western sector extends from Greenwich to the Housatonic River; the central region from Milford to the Connecticut River; and the eastern section from Niantic to the Pawcatuck River.

Using the most probable future conditions and combining New York and Connecticut portions of projected dredging activity, the most reasonable projection of likely dredged material volume for the Sound appears to be approximately 68 million cubic yards in the next 50 years.

CORPS OF ENGINEERS DREDGING, CONNECTICUT AND NEW YORK 1948-1977



COMBINED IMPROVEMENT AND MAINTENANCE DREDGING PERMITTED BY CORPS OF ENGINEERS, LONG ISLAND SOUND, 1968-1977



· SEDIMENT CHARACTER · IMPACTS ·

LONG ISLAND SOUND DREDGING PROJECTIONS
1985-2035
(values in yd^3)

NEW YORK			
Area	Federal		Non-Federal
	Maintenance	Improvement	
New York City East River	2,365	250	4,250
New York City Long Island Sound	140	50	100
Westchester County	350	400	550
Nassau County	180	150	550
Suffolk County	327	150	5,450
TOTAL	3,362	1,000	10,900
AREA TOTAL FOR NEW YORK: 15,262			
CONNECTICUT			
Western Sound	5,695	2,950	3,300
Central Sound	12,885	7,760	11,300
Eastern Sound	1,570	1,900	5,500
TOTAL	20,150	12,610	20,100
AREA TOTAL FOR CONNECTICUT: 52,860			
GRAND TOTAL FOR NEW YORK AND CONNECTICUT: 68,122			

• FINDING A SITE FOR STUDY •

CHARACTERISTICS OF DREDGED MATERIAL

Physical characteristics of dredged material are a function of particle size distribution and specific gravity. Particle size distribution indicates the range and abundance of different sized particles, and specific gravity denotes the weight of particles relative to that of water.

Both factors affect how rapidly the material will settle to the bottom and whether or not water currents will resuspend the material and sweep it away. If the dredged material is placed in a containment area, engineers must think about how quickly the materials will settle and how much they will separate from the water. Very fine particulates settle more slowly and, when settled, retain more water between particles. Settlement rate and water retention, then, determine the space required for containment and dictate the foundation bearing strength of the material, once settled.

Chemical characteristics of dredged materials are determined by the kind and abundance of chemicals in the material. Some of these chemicals occur naturally; others accumulate as a result of man's activities and discharges. Many of these chemicals can be mobilized back into a soluble state during dredging. If the dredged material is discharged in open water, it will be colonized by various benthic organisms. Many of these plants and animals derive a portion of their nutrients or food precursors from the bottom sediments around them. Frequently, the individuals themselves are not harmed by the toxic substances but accumulate the substances, producing concentrations higher than those in the contaminated dredged material. This accumulation, if passed to higher levels in the food chain, as is possible with DDT, etc. can reach man through his various seafoods.

Sediment characteristics vary widely around the Sound. Urbanized harbors frequently receive treated and untreated sewage, industrial wastes, oil spills, general urban runoff, and river and stream discharges.

As an aid in assessing relative contamination of dredged materials, New York and Connecticut have jointly established criteria for classification of dredged materials:

Class I Sediments: Coarse-grained materials with high solid content. Pollutant levels are usually

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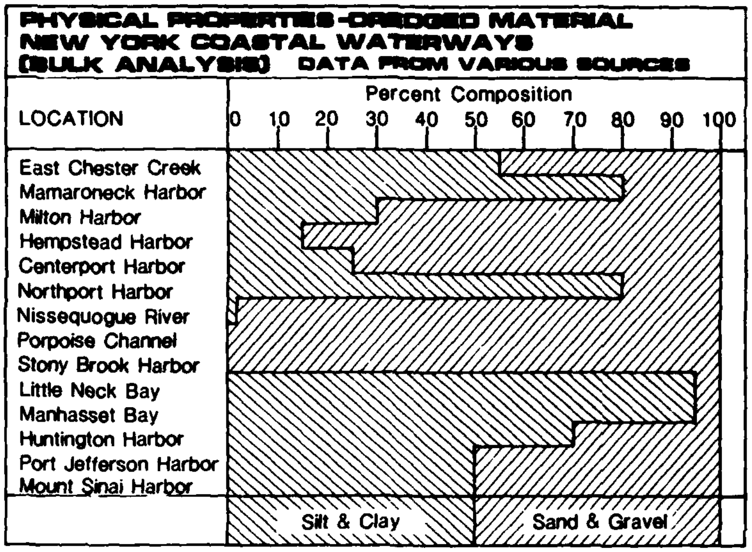

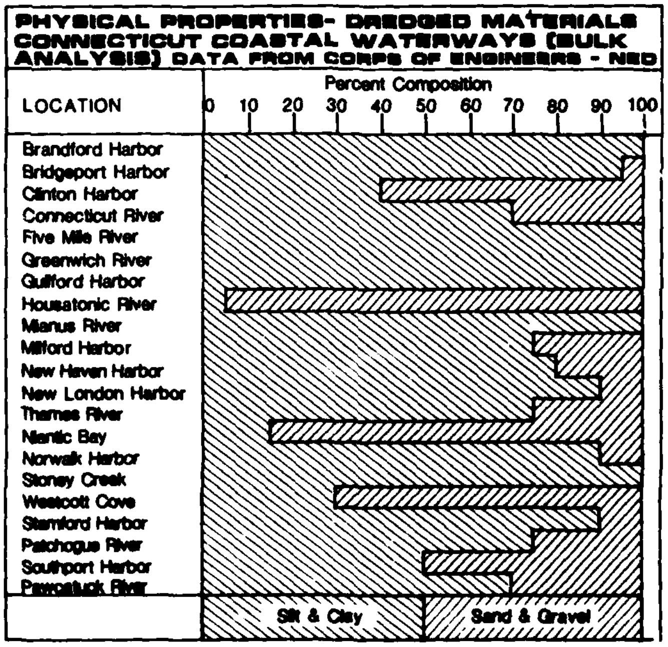

EXAMINING SPECIAL ISSUES · CONCERNS

CHARACTERISTICS (CONT.)

low. Class I sediments are suitable for open water disposal, covering more polluted materials, and beach nourishment.

Class II Sediments: Fine-grained materials with moderate solid content. Usually moderate contaminant levels. Disposal on a case-by-case basis.

Class III Sediments: Usually fine-grained sediments with low solids content. High in contaminants. Class III sediments may be "potentially degrading" or "potentially hazardous." Strict conditions are usually placed on the disposal of Class III sediments. A series of "acceptance" ranges have been established for assessing contaminant or pollution conditions. An examination of typical contaminant and pollutant condition levels in sediments from New York and Connecticut waters reveals that sediments from the Connecticut side of the Sound are consistently more contaminated, regularly falling in Class III.

In general, bioassay and bioaccumulation analysis are required on Class II and III material in accordance with Environmental Protection Agency (EPA) guidelines for Section 103 of Public Law 92-523, Ecological Evaluation of Proposed Discharge of Dredged Material in Ocean Waters. Such disposal requires Section 404 permits and Section 401 Water Quality certification, and Coastal Zone Management consistency requirements approvals. Recently proposed regulations could require application of Environmental Protection Agency (EPA) Section 103 guidelines on all dredging projects of more than 25,000 cubic yards of material. Projects of 25,000 cubic yards or less will still be subject to Sections 404 and 401 and may be required to meet some additional testing on a case-by-case basis. Projects in the Sound utilizing open water disposal require Connecticut Water Quality Certification inasmuch as all three interim disposal site are located in Connecticut.

Sediments are usually not uniformly contaminated. Excavations penetrating recently deposited materials into sediments laid down before industrialization and urbanization usually show much higher concentrations near the surface. Examination of surface and near surface layers does not show clear cut distinctions. Rates of deposition, turbulence, re-settlement, bio-turbation (disturbance of sediment by organisms living in it), and earlier dredging frequently stir up the upper few feet of harbor sediments. Particle size differences can indicate a potential difference in contaminant distribution. Finer material (silt-clay) frequently shows greater contamination than does coarse material (sand-gravel), because of the greater surface area.

Natural processes concentrate heavy metals, chlorinated hydro-

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NEW YORK - CONNECTICUT BI-STATE CRITERIA FOR CLASSIFICATION OF DREDGED MATERIALS
(Values in ppm or mg/l)

Substance or Category	Class I	Class II	Class III
Percent Volatile Solids	5	5 - 10	10
Oil and Grease	5,000	5,000 - 10,000	10,000
Mercury	0.5	0.5 - 1.5	1.5
Lead	100	100 - 200	200
Zinc	200	200 - 400	400
Arsenic	10	10 - 20	20
Cadmium	5	5 - 10	10
Chromium	100	100 - 300	300
Copper	200	200 - 400	400
Nickel	50	50 - 100	100
Vanadium	75	75 - 125	125

CLASSIFICATION OF NEW YORK AND CONNECTICUT SEDIMENTS ACCORDING TO BI-STATE CRITERIA

Substance or Category	New York	Connecticut
Percent Volatile Solids	---	---
Oil and Grase	III	III
Mercury	II	III
Lead	III	III
Zinc	III	III
Arsenic	I	III
Cadmium	II	III
Chromium	I	III
Copper	III	III
Nickel	II	III
Vanadium	---	III

UNDERSTANDING THE PLANNING PROCESS

The Corps of Engineers follows specific planning procedures for development of new disposal areas. These procedures apply even when attention is focused on only assessing the feasibility of a new disposal technique.

Three stages are activated sequentially. STAGE 1-RECONNAISSANCE, determines whether a proposed program merits a survey scope feasibility study and whether preparations should start for work required by the next Stage. The emphasis is on identifying pertinent issues and solutions for any water and land resource management problems. Most of the work conducted for containment in Long Island Sound has been at the Stage 1 level.

STAGE 2-DEVELOPMENT OF INTERMEDIATE PLANS, explores a range of alternatives and management measures. In effect, Stage 2 is a screening process, singling out feasible options. Specific studies are then developed for Stage 3 work. Some Stage 2 preliminary work has been completed for the Long Island Sound containment program, and the workshops following distribution of this booklet will constitute further Stage 2 activity.

STAGE 3-DEVELOPMENT OF DETAILED PLANS, incorporates detailed studies focussing on the remaining viable alternatives. Four planning tasks, used at all stages, now assume greater importance. The tasks center on definition of planning objectives; identification of potential management objectives; identification of potentially significant impacts; and determination of whether the program merits continuation.

Stage 3 activities for the Long Island Sound containment study program will develop after workshop results are assessed and further Stage 2 studies completed.

CHARACTERISTICS (CONT.)

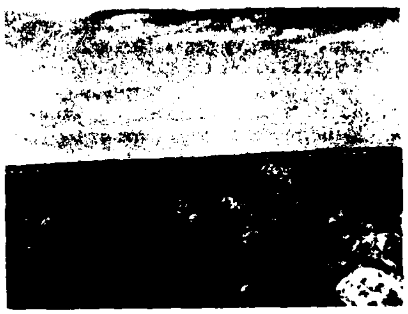
carbons, pesticides, nutrients, and oil and grease compounds in bottom sediments. In oxygenated, surface waters, these contaminants are not usually highly soluble. When significant concentrations enter the water, most of the contaminants are absorbed or adsorbed by suspended particles and then deposited on the bottom when the particles settle out.

Sediments accumulated in bays and harbors gradually develop an anaerobic (no free oxygen) environment extending to within a few inches of the surface. In these anaerobic sediments, heavy metals such as cadmium, copper, chromium, lead, and zinc are stabilized as insoluble sulfides and become immobilized. During dredging and disposal, anaerobic sediments are mixed with oxygen-laden water, initiating a series of chemical reactions. The heavy metals form oxides that are slightly more soluble than the sulfides found in anaerobic sediments. However, iron and manganese are also present in reduced form in the anaerobic sediments and, upon exposure to oxygen-rich water, form oxides more soluble than those of other metals. The iron and manganese oxides tend to coat suspended particles and then attract the other, less soluble metallic oxides. Thus, particles covered with iron and manganese oxide films scavenge the metallic contaminants from the water and settle into the sediments and may produce toxic conditions.

Two types of marine organisms, filter feeders and deposit feeders, convey these contaminants into the marine food chain. Epifaunal feeders are marine invertebrates that feed by drawing large volumes of water through mucus-covered nets and gill-like structures, straining particles from the water. Infaunal deposit feeders ingest deposited sediments and remove nutrient particles, discharging the non-organic residues. Both kinds of animals can have elevated levels of contaminants in their body tissue if their habitat is polluted. Surprisingly, there is often no significant difference in contaminant tissue burdens for the two groups. Near bottom water movement is frequently sufficient to maintain a layer of resuspended material. As a result, filter feeders and deposit feeders draw food and toxic burden from the same contaminant environment.

Filter feeders (i.e., oysters, mussels, quahogs) are counted among man's seafood. Most deposit feeders, worms and certain bi-valves, are not routinely eaten by man, but both are foods for marine animals eaten by man.

In containment areas, a major focus is the retention of water in which the dredged sediment is suspended until settling out is complete. Once most of the toxic substances have been retained in the settled material, the water can be released without transferring contaminants to the Sound's ecosystem. It will also be important to prevent colonization of the containment areas by those organisms which could extract, concentrate, and pass the toxic substances to other components of the Long Island Sound system. Covering contaminated sediments, or capping, with clean sediments is one means of sealing off the polluted material.



HOW TO SELECT A STUDY SITE

An important component of the Long Island Sound containment program is the selection of one or more sites where feasibility studies can be carried out. This does not necessarily mean that any selected locations will actually be used as dredged material containment sites. What it does mean is that there must be a transfer from hypothetical to real locations to develop a basis for accurate feasibility assessment. The analysis must be derived from real data at actual locations. Only in this way can there be a dependable answer to whether dredged material containment is a possible solution to the problem of disposing contaminated sediments in Long Island Sound.

Selection of sites is a major component of the planning process. In the course of planning, a series of limiting criteria will be applied for each site possibility. These criteria are: (a) bathymetry (bottom topography) and the resulting potential containment volume; (b) shoreline ownership and location of existing disposal areas; (c) proximity to special ecological areas, wetlands, or major beaches; (d) wave energy - potential containment wall erosion; and (e) land use compatibility and reuse potential.

Once a series of possible sites are identified, further evaluation will proceed using these additional criteria: (a) engineering feasibility; (b) economic value; (c) environmental considerations; (d) social acceptance; and (e) legal or regulatory requirements. A weighting system is used to develop a matrix for evaluation. Criteria points representing physical and geographic characteristics are also awarded for each site's suitability compared to an optimal site.

Data for general, large scale investigations are usually developed from existing information sources, i.e., charts, maps, previous studies, and surveys. As sites become more specific, the investigations become more refined and greater effort is expended on considerations specifically appropriate for each site alternative.

POLICY ISSUES

Section 150 of the Water Resources Development Act of 1976 (P.L. 94-587), authorizes the Secretary of the Army, through the Chief of Engineers, to "plan and establish wetland areas as part of an authorized water resources development project under his jurisdiction." The Corps of Engineers policy is to encourage the productive use of dredged material and the creation of fish and wildlife habitat, while avoiding actions in existing wetlands. All relevant factors are to be considered in reviewing a proposed disposal site.

In considering whether to create a wetland, or to select alternative methods of waste disposal, the benefits to be gained from creation of the wetland must be judged equivalent to the costs associated with the establishment of the wetland. If the environmental, economic, and social benefits can justify its creation, the wetland alternative can be no more than $400,000 costlier than alternatives.

All costs associated with establishing a wetland under this policy are borne by the Federal government. Policy Issue 79 19 sets forth the Corps' policy for cost sharing for retaining structures for dredged material: "Retaining structures (dikes) will be provided by the Corps unless the authorizing documentation indicates explicity that such structures are a local responsibility, except for cases where retaining structures become a new requirement for maintenance of the project for environmental reasons."

In special cases, the Corps will recommend legislation to modify the local cooperation requirement to include retaining structures, and continue critical maintenance while such legislation is pending. If a containment structure is designed to receive fill from several Federal and non-Federal projects, financial responsibility may have to be defined as a special case.

USES OF DREDGED MATERIAL

Historically, dredged material has been disposed of by the most convenient and generally the least expensive method available. This has translated into dumping on the nearest available open space on land, or more often, in water. The growing concern about contaminants in these wastes has reduced the acceptability of previous methods. Concurrently, economics has reduced the acceptability of transporting dredged materials long distances for offshore open water disposal. The need for dredging and resultant production of huge volumes of materials have led to alternative methods of disposal which minimize damage to the environment and in some instances, prove to be environmental and/or economic assets.

Dredged material can be used for creation of or improvements to wildlife habitat. These sediments can also be used to create upland habitats for mammals, or nesting and feeding areas for waterfowl. In specialized applications, periodic deposition of new material can prevent excessive vegetation and preserve a habitat for species dependent on bare sand for nesting purposes. Where transport is economically feasible, dredge materials can be used to fill abandoned pits and quarries, or reclaim strip mined lands. In areas where grain size is compatible, sediments can be utilized for beach nourishment.

Along waterfront areas, dredged material can expand or supplement existing facilities. Possibilities include such diverse choices as port development, industrial/commercial development, open space recreation areas, and marinas. Proper design of the containment structure to allow access to the intended facility, and requisite drainage to allow settling and compaction of sediments, makes dredged material a candidate for multiple applications in waterfront development. Similar methods can be used to create offshore artificial islands for special facility siting.

PUBLIC INVOLVEMENT

Many opportunities for public review of plans and proposals are provided in the Corps of Engineers planning process. In the Long Island Sound containment study, public participation is channeled into three phases. Initially, lines of communication are established with all affected agencies and non-governmental groups. Secdnd, appropriate Stage I planning documents are circulated for public review and discussion at follow-on public meetings and workshops. Finally, as Stages II and III get underway, specific public involvement avenues are developed, including additional public information meetings and workshops.

This booklet has a dual function. First, it supplies general information regarding the status and nature of the Long Island Sound containment program. Second, it signals the beginning of the public participation process. The Corps of Engineers wishes to obtain comments, suggestions, and guidance for continuation of the study.

The booklet is being distributed to agencies, organizations, and

CONTINUED ON NEXT PAGE

MALODOR ABATMENT

Sediments with organic matter also contain by-products of anaerobic bacterial decomposition, such as hydrogen sulfide, sulfur-containing compounds, fatty acids, aldehydes, amines, and other odorous substances. More often than not, odors emitted by a containment disposal area are not perceptible beyond the vicinity of the receiving basin. Under certain weather and wind conditions, however, odors may be detected at distances from disposal sites. Malodor abatement is, therefore, a matter that must be addressed.

The most important consideration in dealing with an odor problem is the distance of the site from nearby communities and the direction of prevailing winds, especially during warmer weather. Where practicable, a project should be scheduled for periods when the population is indoors, when atmospheric conditions are favorable for optimal dispersion, or when prevailing breezes blow offshore. When dredging cannot be so controlled, a gas release device can be installed in the dredge line at the point most distant from any affected population. Placement of the discharge end of a slurry line underwater can also further reduce release of malodors.

Ozonation and aeration are potential methods for reduction of odors. However, these treatments are possible only when sludge is in a slurry, a condition where efficient gas mixing is difficult. Masking with a counteractive agent is sometimes effective but generally results in a change of odor character with little decrease in intensity.

Once a fill operation is complete, various applications can abate odors. Lime is often used with dewatered sludge. Calcium oxide or other additives can shift the pH beyond the optimal bacterial growth range and thus, decrease gas production. Sealants, such as sand layers, and diffusion barriers, such as wood chips, are other inexpensive alternatives.

PUBLIC REVIEW OF PLANS & PROGRAMS

PUBLIC INVOLVEMENT (CONT.)

individuals concerned with the Sound. In the very near future, a series of Public Workshops will be announced for convenient locations around the Sound. The Corps of Engineers hopes you will plan to attend one or more of these meetings. There is a need for comprehensive review of urgent concerns, and suggestions for possible containment study sites will be appreciated. If you are unable to attend a Workshop, please don't hesitate to communicate your comments in writing.

The Long Island Sound containment study program is a long-term effort to accommodate navigation needs and simultaneously, protect the waters of the Sound. We hope you will make it your program, too.

WORKSHOP MEETING DATES AND LOCATIONS

ALL MEETINGS AT 7:30 P.M.

New London,Conn.-May 18, 1981
Room 113
New London Hall
Connecticut College

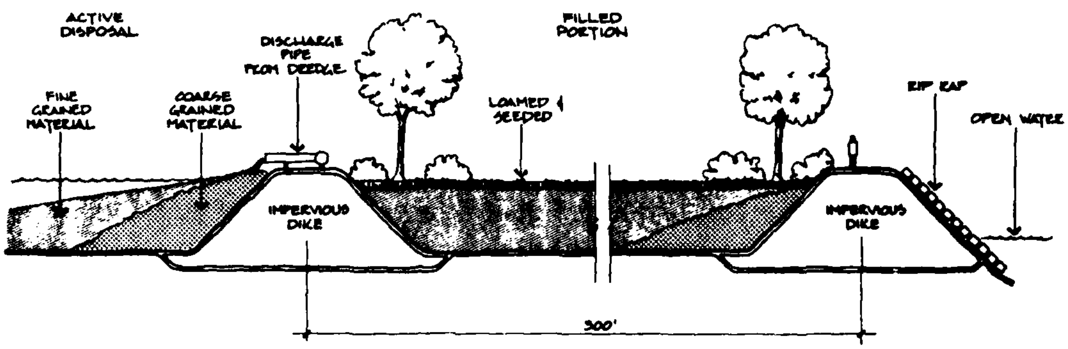
New Haven, Conn.-May 19, 1981
Room A 74
135 Prospect Street
School of Organization and Management Yale University

Stamford, Conn.-May 20, 1981
West Hill School
West Hill St./Roxbury Ave.

Great Neck, New York-May 21, 1981
Room B202
Bowditch Hall
U S Maritime Academy

Public Workshop Notice:

Dredged Material Containment: a new strategy for the Sound?



Cross section of Artificial Island

New London, CT	May 18	7:30 p.m. - room 113, New London Hall, Connecticut College
New Haven, CT	May 19	7:30 p.m. - room A-74, 135 Prospect Street, School of Organization and Management, Yale University
Stamford, CT	May 20	7:30 p.m. - the little theater of West Hill School at the intersection of West Hill and Roxbury Avenues
Great Neck, NY	May 21	7:30 - room B-202 of Bowditch Hall of the U.S. Maritime Academy

Continued recreational and commercial use of many Long Island Sound ports may hinge on finding an environmentally acceptable way to dispose of contaminated sediments dredged from channels and mooring areas. A possible solution to this dilemma will be discussed during a series of four public workshops in May around the Sound. Although new to this region, the containment strategy of containing sediments behind dikes has been used successfully throughout the country to prevent ecological damage from dredged sediments containing chemicals or other toxic substances.

Each workshop will focus on the potential for using coastal or near-shore structures to contain objectional dredged materials in this region. Once filled and capped with clean materials, these structures could serve recreational or commercial uses as biologically productive salt marshes or artificial islands. In either case, the containment structure would be designed to isolate these sediments from the environment. The Corps is prepared to undertake the studies needed to evaluate the effectiveness of containment as an environmentally sound long-range solution to the disposal problem.

A slide presentation documenting use of existing containment structures for managing toxic sediments in the Great Lakes region will open each workshop. Common community concerns – including the potential for contamination and odor problems – will be discussed. Throughout the session questions will be answered. The meeting will also encompass data reported in the "Dredged Material Containment in Long Island Sound" report recently issued by the U.S. Army Corps of Engineers, New England Division. These workshops are sponsored by the Corps of Engineers and coordinated by the Long Island Sound Taskforce, the regional chapter of the Oceanic Society. Your concerns and ideas are vitally important in this study process and your active involvement in the workshop is important. These meetings are designed to provide citizens with information on the concept of dredged material containment. It will also be an opportunity for you to ask questions and voice your concerns or support for this disposal strategy.

For additional background information on Dredge Material Containment in Long Island Sound or to register contact the Long Island Sound Taskforce, Stamford Marine Center, Magee Avenue, Stamford, Conn., 06902 or call (203) 327-9786. All workshops are open to the public but pre-registration is requested to insure availability of workshop materials for all participants.

Register Now!

Please use the enclosed card or call (203) 327-9786 today!

Figure V-24

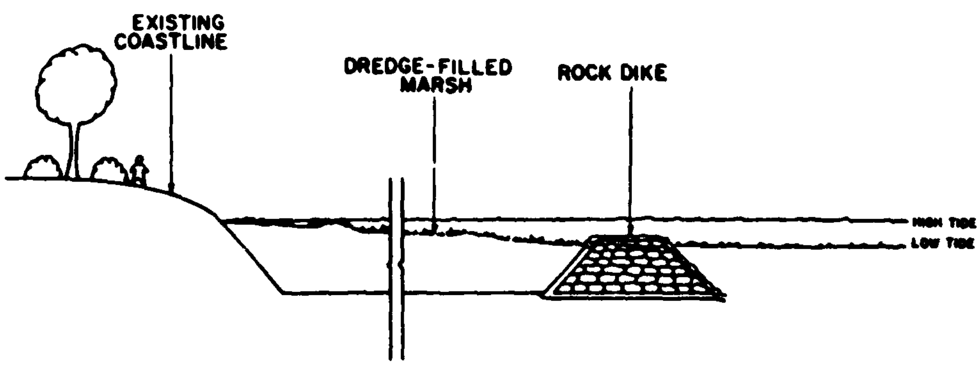
For Registration or Information:

For additional background information on Dredged Material Containment in Long Island Sound or to register contact the Long Island Sound Taskforce, Stamford Marine Center, Magee Avenue, Stamford, CT 06902 or call (203) 327-9786. All workshops are open to the public but pre-registration is requested to insure availability of workshop materials for all participants.

Silt filled harbors + contaminated sediments = dredging problem

Possible Sound solution: containment facilities

or building new salt marshes?



US Army Corps of Engineers
New England Division

LONG ISLAND SOUND

OCTOBER 1981

DREDGED MATERIAL CONTAINMENT

PUBLIC INFORMATION UPDATE

BACKGROUND INFORMATION

The Spring '81 public information brochure reported the preliminary information concerning the nature of the Long Island Sound Dredged Material Containment Study and the containment concept. Copies of the public information brochure are still available from this office. This progress report and update is being distributed as a follow-up to the public information brochure and workshop meetings which were held in May. This update includes a brief summary of each of the ongoing and recently completed work items within this study.

WORKSHOP MEETINGS

Workshop meetings were held in New London, New Haven, and Stamford, Connecticut, and Great Neck, New York, 18-21 May 1981. Immediately prior to the workshops an information brochure was distributed which explained the nature of the study, the issues and problems associated with containment, the unique Long Island Sound ecosystem, the character of dredged material, the site selection criteria and the planning process. The purpose of the workshops was educational: to acquaint the attendees with the concept of dredged material containment facilities (DMCF's), how such facilities work, the environmental issues, and the status of the overall study.

Each workshop session began with an introduction explaining the intent of the study and the purpose of the workshops. Two Corps representatives, a water resources engineer and a marine biologist, then gave slide presentations explaining the containment concept and how its has been used effectively in coastal and riverine waters throughout the country.

Approximately 225 people attended the four workshops. In addition to the general public, attendees included representatives from the State of Connecticut Dept. of Environmental Protection including the Coastal Area Management office, State Waterways Section of the Department of Transportation, State of New York officials, U.S. Fish and Wildlife Service, National Marine Fisheries Service, municipal interests, local businessmen, the media and Congressional aids.

Subsequent to the workshop meetings a Workshop Digest was prepared to summarize the issues and questions raised at each meeting.

REPORTS COMPLETED

The Long Island Sound Dredged Material Containment Study was authorized by Congress in May 1977. The preliminary phase of the study process was completed when the Reconnaissance Report was issued in January 1979. At that time only Connecticut was included in the study area. Upon approval of the Reconnaissance Report by the Chief of Engineers in Washington, D.C., it was recommended that the New York portion of Long Island Sound be included as its waters could be affected by work done in Connecticut.

At Interim Report, completed in July 1980, presents dredging projects and an inventory of past dredging activities for the New York area. This report also included a preliminary siting analysis of potential publicly-owned sites in Connecticut and New York. The Addendum to the Interim Report completed in March 1981, extended the siting analysis to include shallow water areas, municipal wastewater treatment plants, power generating stations, Corps jetties and breakwaters, industrial waste dischargers, petroleum facilities and sand and gravel pits. Over 200 shoreline and near shore areas in Connecticut and New York were evaluated and rated.

FIGURE V-25

SITE CRITERIA

Certain characteristics must be considered in determining the suitability of a potential site for dredged material disposal. A potentially viable containment site would be located along the shoreline or in water of 20 feet or less in depth and close to dredging activities. A preferred site would be an area inhabited by a minimal amount of finfish, shellfish and other marine life with dimensions of at least 400 feet by 600 feet and/or has a capacity of at least 200,000 c.y. Other factors which would be considered in evaluating a site are ease of construction and accessibility for the dredging disposal operations. These will be dependent upon the location and the characteristics of the adjacent areas. The proposed use of the filled facility should be compatible with existing land use in adjacent areas and also with local planning and zoning. It appears that the most publicly acceptable sites are usually areas that would involve creating or recreating a saltmarsh or restoring an area to its former state where severe erosion has occurred.

Areas that are presently saltwater marshes or public use areas are generally not acceptable as potential candidates for DMCF's.

The search for potential containment sites is continuing and we welcome any suggestions from the general public. Any site recommended in the Final Report will be fully coordinated with the general public, local and State officials and other Federal agencies.

PROTOTYPE SITES

A detailed analysis will be conducted to better enable us to estimate the costs and determine possible impacts at potential sites throughout Long Island Sound. These are prototype studies only; no construction is yet being planned. Two sites, Clinton Harbor and Black Ledge (Groton) Connecticut, have been selected as "prototype" study areas for dredged material containment facilities.

Some additional planning studies would be required upon completion of the prototype studies should the results be favorably received by local interests.

The Clinton Harbor site is located west of the Clinton Harbor channel. A containment facility could act as a natural wave and wind break that would protect and stabilize the main channel. This facility, depending on the final design alignment could encompass from 85-100 acres and eventually contain up to 1 million cubic yards (c.y.) but would probably be sized to accommodate a dredging volume of about 300,000 c.y. of dredged material. An opportunity exists here to create an extensive saltmarsh area expanding the Hammonassett Marsh. Preliminary environmental investigations indicate that a portion of this area may once have been a saltmarsh but was eroded by the forces of nature.

Black Ledge is a rocky shoal area located off Avery Point, Groton. This site is envisioned to encompass an area of about 0.5 square mile and would contain material from the eastern Long Island Sound area. Black Ledge is reported to be a hazard to navigation of recreational boating and of minimum value for fishing and lobstering. In addition to serving as a controlled ecological educational studies facility and/or nature preserve, this facility could also provide storm protection to the Groton shoreline.

ENVIRONMENTAL BASELINE DATA

Baseline field surveys are underway and preliminary evaluation will be done on the environmental acceptability of the two "prototype" sites, which appear to be suitable for eventual use as dredged material containment facilities. Physical and ecological conditions will be identified and documented and habitat types will be identified and classified. This information will be used to determine the habitat value and environmental acceptability of constructing a containment facility. A preliminary evaluation of impacts on the physical, chemical, and biological characteristics of the aquatic ecosystem at each site will be performed in accordance with Section 404 of the Clean Water Act procedures and guidelines.

Management and mitigation options and procedures will then be developed. One of the objectives of the containment study is to minimize the adverse environmental impact that could occur due to construction of a containment facility. A site will be considered feasible only if it would disrupt a relatively minor amount of marine life or have mitigation measures

which outweigh any environmental damage incurred due to construction and usage of the site and which has significant public support. This data collection effort is not necessarily to be interpreted as having strong local or State support but rather as an effort on which general comparisons can be made for use in subsequent steps in the overall study to determine the relative merits of dredged material containment as an alternative to other methods of dredged material disposal. A detailed environmental report will be prepared listing all impacts.

OFFSHORE GEOTECHNICAL EXPLORATIONS

Geotechnical data collection will begin soon at the two prototype study sites: Clinton Harbor and Black Ledge. The work sites are located offshore in about 2 to 30 feet of tidal water. The Clinton Harbor site is situated west of the Clinton Harbor channel in a shallow area within 1000 yards from the shore. The Black Ledge site is in open water, east of the New London channel, about 2000 yards from the mainland.

The work to be performed consists of 8 drive sample borings (3 at Clinton and 5 at Black Ledge) to a depth of 40 feet below ground surface and 33 machine probes (11 at Clinton and 22 at Black Ledge) to a depth of 20 feet below ground surface.

ISLAND/SHOAL SCREENING

The feasibility of utilizing island/shoal areas in Connecticut for potential use as dredged material containment facilities will be determined during the next few months. Existing data and/or detailed knowledge of the Sound will be used to determine the viability of each potential site. Factors which will be considered are:

1) biological productivity in the area,
2) shellfish concentrations in close proximity,
3) finfish concentrations in close proximity,
4) size of potential containment facility,
5) existing land use at the site,
6) distance to dredging activities,
7) navigational hazards at or near the site.

This will be a preliminary screening effort to determine where more detailed studies are warranted.

INSTITUTIONAL ANALYSIS

Institutional analysis is one means of assessing the feasibility of alternative plans. An institutional analysis facilitates the identification of government and private entities that will assume the responsibility for carrying out various elements of a plan such as enforcement of laws and regulations or facility construction and/or maintenance.

The institutional analysis for this study has been initiated with the distribution of a preliminary survey of State, local, county, commercial and private interests. The survey will help us to determine which institutions may be involved in implementing a dredged material containment project, the extent of their involvement and the resources they have available. During the planning process, the use of legal and institutional analyses enable the planner to formulate better alternatives as the institutional consequences and requirements generated by each alternative become apparent.

SHERWOOD ISLAND SURVEY

One of several potential island containment sites under investigation is a borrow pit off the coast near Sherwood Island State Park in Westport. According to an official of the Aquaculture Division of the Connecticut Department of Agriculture, material from this area was used in the construction of the Connecticut Turnpike. Other borrow pits which were used at that time are located in Morris Cove and Prospect Beach in New Haven Harbor and Laurel Beach in Milford. Tests indicate that very little if any marine life exists in these very deep pits due to the anaerobic conditions. It has been suggested that these areas could possibly be rehabilitated by filling them with dredged material. Portions of these borrow pits could then be returned to the State for shellfish leases while another portion could be turned into an island for a bird sanctuary. A survey crew has been at the site to collect data to determine the exact location, depth and volume of the Sherwood Island hole. The data is being evaluated and the volumes will then be determined.

MARKET USER SURVEY

A draft report summarizing the activities in 50 ports and harbors located on or adjacent to Long Island Sound is under review by this office. The demand for harbor improvements will aid in projecting future dredged material volumes in Long Island Sound. Projections of port activities included in this market user survey are based on recent trends, planned port development, and anticipated changes in shoreline activities, including possible conversion of electrical generating plants from oil to coal. Information developed for each of the 50 ports include the following:

1) existing port uses, both commerical and recreational;
2) projection of future activities based upon historical and continuous trends, development potential and existing development plans;
3) a "no-action" scenario detailing potential economic impacts if the dredged material disposal problem is not solved;
4) potential uses of the new land created are addressed in a preliminary manner based on present and anticipated future demand for shoreline facilities and water transport.

A straight-forward approach was used to identify and obtain relevant information. Existing up-to-date literature sources were utilized but the largest and most significant sources were individuals knowledgeable of conditions in each of the subject ports. Direct, face-to-face interviews and telephone interviews were conducted with major channel users; local port authorities; Chambers of Commerce; State, regional and local planning agencies; and local harbormasters and municipal yacht club officials. Discussions were also held with various State and Federal agencies and individual electrical utilities regarding the oil-to-coal conversion issue.

ECONOMIC AND SOCIAL IMPACTS

An analysis of social and economic impacts associated with the construction of containment structures at five potential shoreline locations in Long Island Sound will soon be completed. The sites being evaluated are Clinton Harbor, New Haven Harbor, Fayerweather Island and Yellow Mill Channel in Bridgeport Harbor, Black Ledge at Groton and Two Tree Island at Waterford. Potential uses of each proposed containment facility will be determined.

Impacts during the contruction period shall be addressed, as well as long term impacts subsequent to completion of the facility and adoption of eventual use. Effects on the following social and economic factors will be addressed: life, health, safety, community services and facilities, recreational opportunities, employment, land values, transportation, and commerical and industrial activity. Both short and long term impacts will be considered.

The social acceptability of containment facilities will be determined based on the views expressed during the dialogue portions of the public workshops, 18-21 May 1981, and contacts with local officials and organizations. An economic analysis of the cost efficiency of each proposed facilities is being conducted. This will include the determination of:

1) the most efficient service area
2) the adequacy of proposed capacities
3) the unit cost of containment disposal vs. unit cost of alternative disposal methods
4) economic return through use of "new" land.

For more information contact: Richard Quinn or Karen Kirk
Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254
(617) 894-2400, Extension 215

THE OCEANIC SOCIETY

EDUCATION • RESEARCH • CONSERVATION

EXECUTIVE OFFICES
Magee Avenue
Stamford, Ct. 06902
(203) 327-9786

Dear Coastal Citizen:

You are invited to assist in a feasibility study examining the potential of utilizing islands and shoal areas along the Connecticut coast for use as dredged material containment facilities. The Oceanic Society is conducting this research under contract to the U.S. Army Corps of Engineers, New England Division.

Our goal is to determine whether ten specific sites should be studied further in the search for locations suitable for dredged material containment through creation of islands. Inclusion of an area in this effort clearly does not signal any firm plans for construction of a containment facility. Rather, we are working to identify sites which merit detailed scientific examination and environmental review.

Locations identified by the Corps of Engineers for the study include:

* the Captain's Harbor area off Greenwich;
* the Norwalk Islands off Norwalk Harbor;
* the Thimble Islands off Stony Creek;
* the Falkner Island area off Guilford;
* the Six Mile Reef area off Clinton;
* the Duck Island Roads area off Clinton and Westbrook;
* the Bartlet Reef area off Waterford;
* the Stratford Shaol area off Stratford;
* the Menunketesuck Island area off Clinton; and
* the Charles Island area off Milford.

FIGURE V-26

Western Regional Office / OCEANS Editorial Office / Expeditions Office: Fort Mason, San Francisco, Ca. 94123. (415) 441-1104
Mid-Atlantic Regional Office: Center for Ocean Studies, Gardner's Basin, Atlantic City, N.J. (609) 348-5252

One of the most difficult parts of this study is considering the competing interests for the shallow waters most suitable for islands extension or construction. We would appreciate your assistance in acquiring information on the different values of these areas.

Specifically, during the study we will by analyzing each location in terms of:

* biological productivity, or whether the area plays an important part in the Sound's marine ecosystem;
* shellfish concentrations, to reflect location of oyster, clam and scallop beds;
* finfish concentrations, to identify areas important for sport and commercial fishermen; and
* navigational hazards at or near the site. We will also consider existing land use at the site, distance to exsiting dredging activities, other potential impacts and size of potential containment facilities suitable for each area.

We hope you will assist us by submitting your comments to our staff within the next four weeks. Please contact me at the Oceanic Society, (203) 327-9786, if you have any questions on this study.

Thank you for your consideration and assistance in this project. We look forward to hearing from you on this important topic.

Sincerely,

Thomas C. Jackson
Vice President

TCJ:bas

US Army Corps of Engineers
New England Division

LONG ISLAND SOUND

AUTUMN 1982

DREDGED MATERIAL CONTAINMENT

PUBLIC INFORMATION UPDATE

The Long Island Sound Dredged Material Containment Study was authorized by Congress in May 1977. The study is being conducted by the U.S. Army Corps of Engineers, New England Division, to determine the feasibility of implementing Dredged Material Containment Facilities (DMCF) in the Long Island Sound area as an option for the disposal of dredged materials from the region.

SPRING 1983 WORKSHOPS

Our second series of workshop meetings are tentatively being planned for March 1983. Two or three meetings will be held in Connecticut, probably in the New London, New Haven, and Stamford areas as was done in May 1981. The meeting in Stamford will be within an easy commute for residents of Westchester County. At present there are no potential sites being considered in either Nassau or Suffolk Counties.

The purpose of the workshops will be to provide local officials and the general public with a more detailed account of the work items completed since the last workshops. A workshop brochure will be distributed prior to the meeting. We will also highlight the results of our progress report which will be completed this coming December. The report focuses on the detailed analysis of the Clinton Harbor and Black Ledge sites with some preliminary analysis and evaluation of several other sites in Connecticut and New York.

REPORTS COMPLETED IN PAST YEAR

Following the May 1981 Workshop meetings, a digest summarizing the issues and questions raised at those meetings was prepared. It was distributed to all attendees and to the public upon request.

A market user survey, completed in August 1981, summarized the existing port uses and navigational problems for the major commercial ports and existing levels of activity at the smaller, recreational ports. Projections of future activities for the subject ports and a "no-action" scenario (should dredging not continue) were developed. Potential uses of the land created by the future disposal activities were also addressed based on present and future shoreline activities.

An analysis of the social and economic impacts which would be associated with the construction of dredged material containment facilities at six of the potential locations in Connecticut was made. Both the short-term construction and implementation impacts and the long-term final use impacts were examined.

All of these reports are available at this office upon request.

PREVIOUS PUBLICATIONS

The Spring '81 public information brochure presented preliminary information concerning the nature of the Long Island Sound Dredged Material Containment Study and the containment concept. A limited number of copies of the public information brochure are still available from this office. An October 1981 Update served as a follow-up to that brochure and the May 1981 workshops. It included brief summaries of each of the work items which were then underway, planned or recently completed. This Autumn '82 Update is designed to summarize the Corps activities on the project since that time.

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FIGURE V-27

SITE SCREENING STATUS

Several preliminary siting analyses have been accomplished to date and numerous areas have been evaluated for their suitability for containment facilities. Many of these sites have been derived from public input. The sites currently being considered are:

* Clinton Harbor, Clinton & Guilford, CT
* Black Ledge, Groton, CT
* Sherwood Island Burrow Hole, Westport, CT
* Yellow Mill Channel, Bridgeport, CT
* Penfield Shoals/Reefs, Fairfield, CT
* Milford Harbor Jetty, Milford, CT
* Gold Star Bridge, New London, CT
* Menunketesuck Island, Westbrook, CT
* Guilford Harbor Disposal Area, Guilford, CT
* Housatonic River Breakwater, Milford, CT
* I-95 Interchange, West Haven, CT
* Flushing Bay, New York, NY
* Mamaroneck Harbor, Rye & Mamaroneck, NY

Sites which have been eliminated for environmental reasons based on our study are:

* Bayview Park, New Haven, CT
* East Shore Park, New Haven, CT
* Fayerweather Island, Bridgeport, CT
* Seaside Park, Bridgeport, CT

Sites eliminated due to high costs involved are:

* Twotree Island, Waterford, CT
* State Maritime College (Throgs Neck Bridge), New York, NY

ENVIRONMENTAL BASELINE FIELD SURVEYS

Multidisciplinary environmental surveys were conducted at both Clinton Harbor and Black Ledge. The objectives of the survey were to identify and document the physical and ecological conditions of the area, identify and classify habitat types; and determine the habitat value and environmental acceptability of constructing a DMCF.

The Clinton Harbor site evaluation work is comprised of 5 discplines:

* Collection of physical oceanographic data
* Tidal hydrodynamic modeling
* Sediment-water interface photogrametry and habitat evaluation
* Survey of benthic macrofauna, finfish, shellfish, algae and marsh plants.
* Marsh-creation feasibility evaluation.

The hydrodynamic simulation indicated that tidal current patterns and flushing characteristics of the harbor do not appear to be detrimentally altered by the proposed development. The most significant effect of DMCF construction would be an increase in tidal velocities in the outer harbor where such changes could produce significantly increased sediment transport.

Within the area of the outer harbor (DMCF site), sediments were determined to be unstable and in a state of chronic minor and periodic major resuspension. This unstable bottom does not allow the establishment of complex, balanced biological communities. It appears that the frequency of physical disturbance in this area is sufficient to limit its value as a habitat. The area was determined to have high potential for biological enhancement through the establishment of a marsh on the deposited materials.

This enhancement would occur in several areas, including:

(1) the marsh proper, incorporation of over 70 new acres of Spartina alterniflora (salt marsh grass) habitat:

(2) nearly 30 acres of shallow subtidal inlet-type habitat; and

(3) nearly 5000 linear feet of rock breakwater providing hard bottom suitable for colonization by a diverse macrofaunal community.

The investigations undertaken to date indicate no serious adverse ecological impacts from the proposed DMCF construction and have actually identified several projected benefits.

For the Black Ledge site, a sampling plan comprised of diver-operated suction sampling and traditional grab sampling was designed. A sediment-water interface survey was conducted at the deeper stations to the south and west of the shoal. The diver sampling of rocky bottoms was conducted along 3 lines and samples were taken at 5', 10', 20' and 30' along each.

The findings of this survey indicate that periodic physical disturbance in the area is apparently sufficient to prevent the establishment of communities with higher successional states. The frequency of disturbance appears to be greater in areas of less than 30' depth; however even the deeper stations sampled exhibited evidence of a history of recurring periodic disturbance.

On Black Ledge, wind and tidally driven currents and waves create a hydro-

dynamic regime which limits the fauna to those species adapted to a hard-bottom, high-energy habitat. The most conspicuous feature on the ledge was a dense and virtually uninterrupted covering of mussels at least one layer thick on all available rock surfaces.

GEOTECHNICAL INVESTIGATIONS

From November 1981 through January 1982, a preliminary subsurface exploration program consisting of machine probings and borings was performed in order to define foundation conditions. A total of 11 probes and 3 borings were performed at Clinton Harbor and 22 probes and 5 borings were performed at Black Ledge. Overburden samples recovered from the exploration program were tested at the New England Division Materials and Water Quality Laboratory for the following: gradation, both by sieve and hydrometer; Atterberg limits; organic content; water content; and specific gravity. The bedrock samples from Black Ledge were tested for specific gravity, absorption, and unconfined compressive strength.

At Clinton Harbor the offshore area is generally flat, with boulders providing some relief. Minimum offshore elevation at the site is approximately -8 feet National Geodetic Vertical Datum (NGVD). Soil conditions in the foundation area consist of surficial deposits of granular soil overlying very soft organic silt to undetermined depth. The granular soil is predominantly loose, medium to fine sand with shell fragments interbedded with deposits of loose to moderately-compact, silty sand and moderately-compact gravelly sand. The depth of sand deposits varies from 7 to 30 feet within the prototype dike alignment.

The offshore area at Black Ledge is generally flat, with numerous areas of resistant bedrock, such as Black Ledge, providing relief. Minimum offshore elevation at the site is approximately -14 feet NGVD. Soil conditions consist of a surficial deposit of very loose, silty sand with shell fragments and plant matter ranging in depths from 1 to 6 feet. In general, the surficial deposits are underlain by a strata of moderately compact, granular soil ranging from fine sand to silty, gravelly sand. Along the westerly half of the area, the granular soil overlies very dense, silty, gravelly sand or bedrock. Bedrock was encountered in 2 borings at depths of 14 and 10 feet below ground surface. In the eastern half, moderately-compac fine sand and silty, gravelly sand overlies moderately-compact inorganic silt.

Due to reasonably poor foundation conditions at both Clinton and Black Ledge, the orginally proposed alignments were altered to avoid soft soil and deep water. The Clinton Harbor prototype facility has a crest elevation 6 feet above mean low water (MLW) (+4 NGVD), a 12-foot top width and side slopes 1 vertical on 2.5 horizontal. Riprap will be placed on the ocean side of the dike and a gravel blanket on the containment side slope.

The Black Ledge prototype design has a crest elevation of +13.5 MLW (+12 NGVD), a 14.5-foot top width and side slopes of 1 vertical to 1.5 horizontal. To protect the dike against overtopping, the slope proteciton (1000-2000 lbs stone) will be placed over the crest and down the inside slope to an elevation of -6 feet MLW.

ECOLOGICAL SURVEYS

The survey, recently completed at Penfield Reef, will be divided into 3 tasks: (1) Direct diving observations and underwater photographic documentation will be conducted for 6-7 transects; (2) Sixteen benthic grab samples will be collected between and along the transects where unconsolidated sediments exist; and (3) Data processing will include a tabulated listing of species and numbers by station as well as statistical analysis.

At Milford Harbor, grab sampling and data analysis will be the same as at Penfield Reef but limited to 12 samples. No diving will be included in the Milford survey.

WAVE ENERGY ANALYSIS

A wave energy analysis and sediment transport study of Clinton Harbor will soon be completed. The objectives of this study are to: (1) analyze the wave energy regime for Clinton Harbor and possible modifications to that regime resulting from alternative DMCF placement and alignment, and (2) project possible changes in sediment erosion and deposition patterns in Clinton Harbor due to both wave and current-induced energy regimes. The work includes a field reconnaissance and subsequent analysis of wave refraction patterns using a computer model. Information obtained from this work will be useful for design of a DMCF to reduce adverse impacts.

CHANGES IN CORPS DREDGING POLICY

The Federal Water (or Civil Works) Program is finding it increasingly difficult to compete for even a small share of the Federal budget. The civil works budget for this year is essentially the same as it was five years ago. At the same time, the operations and maintenance (O&M) expenditures have increased. Completed projects have added to O&M responsibilities and previous O&M expenses have increased due to inflation leaving

less funds for potential new construction. Although water projects represent less than 1 percent of the total Federal budget, it is increasingly difficult for them to obtain funding under current guidelines.

It has been estimated that during the 1980's Federal navigation projects could cost $8 billion with another $5 billion required beyond the '80's. While addressing the New England Governor's Conference Forum on Dredge Management in September 1982, William Gianelli, Assistant Secretary of the Army For Civil Works stated that, "Without basic changes in the cost-sharing and financing policies governing them, it is apparent that the looming budget deficits will not create a more hospitable climate for further funding in the near future." He also stated that the current administration views the O&M of waterways and ports and the capitol improvements and rehabilitation of existing navigation works as an unnecessary burden to the Federal taxpayer.

The emphasis now is towards new financing approaches, called innovative financing, in water project development. The administration wants the costs of improvements to be assigned to beneficiaries and recovered over time. The "marketable" nature of navigation services can provide the basis for non-Federal sponsors to finance some of the capital costs. For deep draft ports, authority will be needed to charge user fees for financing a major harbor improvement. The administration's cost-recovery proposals which have been sent to Congress, address harbors and channels of more than 14 feet deep and inland waterways. Mr. Gianelli's 4 basic objectives in navigation cost recovery legislation are:

(1) Cost assignable to commercial navigation should be recovered from the commercial users.

(2) The test of a project's feasibility should be the willingness of the direct beneficiaries to pay for it.

(3) Recovery of the O&M costs should be on a system wide basis or a waterway or port-specific basis.

(4) Fast-tracking of navigation improvement projects should be an integral part of the legislation.

As Mr. Gianelli has stated, "No one likes to see a change in the status quo, but the realities of the national economic situation demand it in the case of cost recovery for the Nation's waterways and harbors."

These changes in policy could greatly affect the containment study. If the local communities do not intend to continue dredging, the 50-year projections previously developed are meaningless. Thus the need for containment facilities would be severely reduced.

FUTURE COURSE OF ACTION

At the present time the future course of action for the containment study is uncertain for a variety of reasons. Much of the future study efforts depend upon the environmental conditions at each potential site, the social acceptance of the proposal, the foundation characteristics and design criteria for the facility, the location of the site in relation to dredging projects, and the new cost-sharing guidance being proposed by the present administration.

Detailed environmental sampling has been conducted at the Clinton-Hammonasset area, the Black Ledge-Groton site, and the Yellow Mill channel in Bridgeport. Background environmental baseline data collection efforts are presently underway at four additional sites and will be completed shortly. A planning aid letter describing environmental conditions at a total of 14 sites was received from the U.S. Fish and Wildlife Service in late October and is presently under review. The results from the island screening report are also being evaluated.

Other studies are underway and scheduled for completion by late November 1982 that will describe the foundation conditions and approximate construction costs at most of the above sites. While some evaluations based strictly upon the data available will be made in our Progress Report (scheduled for completion in December 1982), final decisions on where to conduct additional detailed studies will not be made until the Spring 1983 public workshops.

Finally, the entire future of dredging existing, authorized Federal channels is uncertain. The present Assistant Secretary of the Army, William Gianelli, has recently indicated that any existing Federal channel having an authorized depth of 14 feet or less will no longer be maintained by the Corps of Engineers. Presently, only 7 harbors in Connecticut (Mystic, New London, Connecticut River, New Haven, Housatonic River, Bridgeport, and Stamford) have authorized depths larger than the 14 foot criteria. Apparently dredging of these harbors will be done by the Corps, but user fees will be assessed. At this time, the administration's cost-sharing proposals are under Congressional review. Definitive cost-sharing procedures will not be known until legislative action is complete.

INSTITUTIONAL ANALYSIS

Federal & Non-Federal Responsibilities

Policy Issue No. 79-19 states that retaining structures (dikes) will be provided by the Corps unless the authorizing documentation indicate explicitly that such structures are a local responsibility, except for cases where retaining structures become a new requirement for maintenance of the project for environmental reasons. If retaining structures become a new requirement, the Corps will recommend that the local cooperation requirements be modified to include retaining structures unless an exception is justified based on special circumstances. The Corps will provide the necessary retaining structures until Congress modifies the local cooperation requirements.

In planning new navigation projects, the present Corps policy is to require local interests to provide without cost to the United States all suitable areas required for initial and subsequent disposal of dredged material and all necessary retaining dikes, bulkheads and embankments therefore, or the costs of such retaining works.

It is Corps policy to secure the maximum practicable benefits through the utilization of material dredged from navigation channels and harbors, provided such use is in the public interest. Use of suitable non-contaminated dredged materials can include creation of wetlands, nourishment of beaches, erosion control of river banks and land reclamation. In accordance with Section 150 of Public Law 94-587, up to $400,000 may be expended by the United States to create wetlands from dredged material. Utilization of dredged material for other uses may be undertaken provided extra cost to the U.S. is not incurred.

Coordination

We have attempted to coordinate our planning efforts with all pertinent local, regional, county and State agencies. Representatives of many of the various agencies attended the May 1981 workshop meetings. In addition to telephone contacts and letters, communications have been maintained through the Public Information Brochure and updates. Coordination with the State of Connecticut has been through the Department of Environmental Protection and Department of Transportation. Regional planning agencies which have been kept informed of our activities are: Southeastern Connecticut, Connecticut River Estuary, Greater Bridgeport and Southwestern. Cooperation of the local waterfront and harbor groups will be extremely important in implementing a containment project.

In the State of New York, coordination has been through the Department of Environmental Conservation and the Department of Transportation. Also in New York we have contacted the Nassau County Department of Public Works (DPW), the Suffolk County DPW, and the New York City Ports and Terminals. We have also met with the Long Island Regional Planning Board to discuss the containment study and its applicability to Long Island.

Connecticut's coastal management plan provides a common basis for the review of impacts of uses on both coastal resources and future water-dependent development. The Coastal Management Act (Public Act 78-152) provides the legal authority for insuring that State and local agencies review coastal impacts by means of unified goals & policies. The coastal management boundary is defined as: (a) the seaward extent of the State's jurisdiction over the waters of Long Island Sound, (b) coastal rivers of the State to their salt water extent, and (c) a three part inland border delineated by the U.S. HUD Flood Insurance lines, or 1000 feet from mean high water mark or 1000 feet from tidal wetland boundaries, whichever line is farthest inland.

The Coastal Area Management (CAM) Unit, within the Department of Environmental Protection, coordinates, supervises and assists the activities of existing State and local agencies in implementing coastal management requirements. The CAM Unit is responsible for reviewing the consistency of Federal agency activities with the State's coastal program. Federal activities and development projects, which significantly affect the coastal area, are subject to a consistency review. These activities and projects must be consistent with the management program to the "maximum extent practicable" (capable of being done to the fullest degree permitted by existing Federal law.)

Before a final decision is made on a project, the Federal agency must provide a consistency determination to the CAM Program. This can be accomplished through the environmental impact statement if it indicates whether or not the proposed project will be consistent to the "maximum extent practicable" with Connecticut's CAM Program; evaluates the relevant provisions of the CAM Programs goals and policies; describes the projects associated facilities, and coastal area effects; and provides sufficient data and information to support the agencies' consistency statement.

The State will review the Federal agency's consistency determination and inform the agency of its agreement or disagreement at the earliest practicable time. The CAM Advisory Board may also elect to review the consistency determination and the CAM Program coordinates the State's comments. If CAM disagrees with the consistency determination, the response will explain how the proposal is inconsistent, alternative measures which would be consistent and any additional information needed to determine its consistency.

Coordination with public interest groups in the study area has been extensive. In May 1981 the Long Island Sound Taskforce (LIST), the regional chapter of the Oceanic Society, under contract to the Corps of Engineers, coordinated and moderated a series of four public workshop meetings to provide everyone the opportunity to learn about the study, the containment concept and sites being considered.

Prior to the workshops, we distributed approximately 2,500 copies of the information brochure to various groups including nearly 100 public

interest groups such as the local chapters of the Audubon Society, the Sierra Club, and the Appalachian Mountain Club; local wetlands commissions and watershed councils; the League of Women Voters; and a variety of other organizations. The brochure explained the nature of the study, the issues and problems associated with containment, the unique Long Island Sound ecosystem, the characteristics of dredged material, the site selection criteria and the planning process.

At the workshops everyone was given the opportunity to ask questions or comment. Subsequently the Taskforce compiled the Workshop Digest summarizing the issues and questions raised at that time.

This coordination is expected to continue through the final planning stages. Public interest groups will be kept informed of the study's progress through Public Interest Updates.

Letters indicating interest in, and support of, the containment study have been received from Clinton, Groton, Bridgeport, Fairfield, Stratford, New Haven and Milford, Connecticut, Mamaroneck and Larchmont, NY, and Westchester County.

Several businesses expressed interest at the workshops and letters have been received from the Clinton Waterfront Association, the Westport Downtown Merchants Association and marina owners in various harbors.

Several public groups have become involved in the planning efforts; disseminating information concerning the study (i.e. LIST) and suggesting potential sites (i.e Great Gull Island Association).

Potential Local Project Sponsors

To assess the capabilities of institutions which may have an interest in sponsoring a dredged material containment facility, a preliminary survey of institutions was conducted. This survey consisted of a brief description of the containment concept and twelve questions which would facilitate the evaluation of the approximately 100 institutions contacted. The survey questions were sent to the Mayors and Selectmen of each of the cities and towns in the study area - both Connecticut and New York. Several yacht clubs, marinas and local industries which had previously expressed interest were also included in the survey as were State, county, and regional planning agencies and local harbor and waterfront groups. The questionnaire and the responses, in tabular form, are shown on Table V-16.

There was overwhelming agreement that there is interest in continued dredging and that disposal of dredged material is a problem. The containment concept does appear to be a potentially acceptable alternative and several sites were suggested; some of these have been previously considered or are currently being investigated. Respondees included mayors, town supervisors, engineers, planners and private business owners. Many

others indicated that their institution may be willing to sponsor a DMCF and some may be interested even if cost-sharing is required. Many others answered that they were interested but lacked funding. Coordination with the Coastal Area Management program and maintenance and regulation of the area for recreation by the State or local government was generally favored.

Plan Implementation

Shoreline extension, using dredged material as fill, is not a new concept. Municipalities in Connecticut and New York have often used dredged material for beach nourishment and creating new park land such as East Shore Park in New Haven. Disposal of clean material is much less of a problem than disposal of material containing PCB's, heavy metals, chlorinated hydrocarbons, pesticides, or oil and grease. Public opposition to using such traditional methods as open water disposal for contaminated sediments has led to investigation of alternative methods of disposal. Dredged material containment facilities isolate the contaminants from the ecosystem minimizing the potential for impacts. In rivers and harbors which are remote from the designated open water disposal sites, containment may also be a more economical means of disposal.

Each potential containment site is unique and must be evaluated individually to determine if it is a feasible option from an economic and engineering standpoint and how, by whom and when the project could be implemented. Three sites Clinton Harbor (Madison and Clinton, CT), Black Ledge (Groton, CT) and Yellow Mill Channel (Bridgeport, CT) are presented as varying examples of how, by whom and when a containment project could be implemented. Any proposal for these sites would be coordinated with the State of Connecticut, Coastal Area Management Office, which has jurisdiction over the land below mean high water.

Legal Issues - Jurisdiction over these sites, in the sense of ownership, is determined by the Common law of Connecticut regarding ownership of the intertidal zone. The State has title to all lands between the high and low water marks. Any newly created land would be owned by Connecticut also. Where there is title to land bordering the intertidal zone, title also accrues over the accessions to the soil which accrue between high and low water mark whether the line of high water mark is changed by natural or artificial causes.

Under present Corps policy, local interests are required to provide without cost to the U.S. all suitable areas for initial & subsequent disposal of dredged material and all necessary retaining dikes for new navigation projects. Therefore during disposal operation and subsequent to the completion of disposal the State of Connecticut would be required to maintain the dike, unless of course a break occurred due to the negligences of either the United States or its contractor, in which case the responsible party would be required to repair any damages.

Any local zoning or land use regulations barring or otherwise adversely affecting construction of the facility would have to be changed by local authorities or exceptions might have to be issued. Local authorities would be contacted regarding any such regulations.

Initially, the Corps of Engineers would have the right to deposit all the material necessary to complete its dredging project. The State would determine who else might have this right. The State would probably assess fees for disposal of material on its property to anyone except the United States.

Examples - The Clinton Harbor site is located west of the channel and south of Cedar Island. The existing channel in Clinton Harbor was authorized in 1938. House Document #240 containing the authorization states that it is the responsibility of local interests to "provide, free of cost to the United States, suitably located and bulk-headed spoil disposal areas for new work and for subsequent maintenance as required..." Consequently, without special authorization from Congress, it is explicitly stated in the authorizing documentation that the cost of a containment facility will be borne by local interests.

The Clinton Harbor site is more suited for a marsh creation project than a true containment facility. A marsh creation project also requires dikes but for stabilization of marsh sedimentation rather than containment of objectionable material. Up to $400,000 can be expended by the United States for the creation of wetlands from dredge material. If the total cost of the project was under $400,000, the Corps could build the necessary dikes and appurtenant structures and operate and maintain the facility during its 25-year usage as a disposal area. Upon completion of the project, ownership could be transferred to the adjacent Hammonassett State Park. Another possibility for its eventual use would be as a wildlife preservation and passive recreation area owned and maintained by a municipal group such as a harbor commission, conservation commission, or land trust.

Black Ledge is a rocky shoal area, east of the New London channel, about 2,000 yards off the coast near Avery Point, Groton. A containment facility at this location would be an artificial island of approximately 0.5 square mile area which could serve as a regional disposal facility for eastern Long Island Sound. If the project is acceptable to Congress, it could possibly be built, operated and maintained by the Corps. The New London Harbor authorization makes no reference to the means of disposal of material dredged from New London and consequently, according to Policy Issue 79-19, retaining structures could be provided by the Corps. When the facility has been filled it could be transferred to the State of Connecticut, the City of Groton or a land trust which would be responsible for developing a park or bird and wildlife sanctuary and then maintaining the facility.

A third site is Yellow Mill Channel in Bridgeport. If the improvement dredging of Bridgeport Harbor is to be done, the City of Bridgeport will have to designate a disposal site. One potential disposal site is Yellow Mill Channel, where a dike could be built across the channel above the I-95 Bridge. The banks of the upper portion of the channel have been reported to be populated by rats and it is generally considered to be an area greatly in need of improvement. Filling in the channel has been considered by the City and would prevent drownings such as have occurred in the past. City officials have expressed interest in creating a park which is especially needed in this high population density area.

It would be a local responsibility to construct the retaining dike and modify the storm drains into the channel. However, if this facility were available, the cost of the improvement dredging of Bridgeport Harbor would be significantly less than if open water disposal was used. The Corps of Engineers would operate and maintain the facility during its life as a disposal area. After the area is filled, dewatered, and capped with clean material, it could be transferred to the City of Bridgeport to develop a park and recreation area.

SUMMARY

Dredged material containment facilities are a new concept for Long Island Sound. There is no precedent or established means of implementing this type of project and consequently, the method for implementing a containment project will have to be determined on a case-by-case basis. It will require careful coordination and cooperation among the Corps of Engineers, the Connecticut Department of Environmental Protection, the New York Department of Environmental Conservation, various local agencies and private and public interest groups.

The first step is to find sites which are available and acceptable to all groups involved. The Corps of Engineers will then design and estimate the cost of an appropriate facility to meet the needs of that particular area. Financial responsibility for purchasng the land and the construction of the weirs and dikes must then be determined. Ordinarily it is a local responsibility to provide the disposal area for a particular dredging project, however if a containment structure is designed to receive material from several Federal and non-Federal projects, financial responsibility may have to be defined as a special case. Another issue which must be addressed is who, in addition to the Corps, may use the facility and what should be charged as a user's fee and by whom. The Corps of Engineers is usually responsible for maintenance of the facility while it is being used for disposal operations. After the facility has been filled to capacity it can be developed by local interests as a wildlife preserve or recreation area.

Questions:	Is there interest in continued dredging of rivers & harbors?	Is disposal of dredged material a problem or potential problem?	Is dredged material containment a potentially acceptable alternative?	Where are potential DMCF sites which would be useful to you?	What is the nature and extent of your authority in relation to this concept?
Institutions:					
Guilford, CT	Yes	Yes	Yes	Grass Island, to counter erosion	Chief Executive Officer of municipality
Norwalk, CT	Yes	Yes	Yes	Don't know	Mayor (presents it to City Council)
Waterford, CT	Yes, primarily recreational	Yes	Yes	Long Island Sound	Unknown
Westbrook, CT	Yes, critical to industry	Not in Westbrook	Reasonable	New Barrier Islands	Municipal Gov't
Groton, CT (town)	Yes	Yes	Possibly	Black Ledge & Two Tree Island	Review & comment on permits, CAM
Groton, CT (city)	Yes	Yes	Yes	Long Island Sound, Fishers Island Sound	Mayor
West Haven, CT	Yes	Yes	Yes	Sandy Point, I-95 & Conrail @ West River	City owns adjacent property
Westport, CT	Yes, Saugatuck Harbor & River	Yes	Dependent on location	None	None, unless above MHW or attached to land. Regulate new islands.
Milford Harbor, Comm.	Yes	Yes	Yes	Fort Trumbull Beach	Harbor improvement agency of Milford
Guilford Harbor Comm.	Yes	Yes	Yes	Grass Island, Hogshead Pt., Jacob's Beach Playground, Guilford Yacht Club, Chittenden Park	Prepare & present dredging programs to Selectmen & Town Meeting
Connecticut River Estuary Reg'l Planning Agency	Yes	Yes	Yes	Need detailed thought & study to identify	Area-wide planning, general conceptual, recreation-oriented uses.
Southeastern CT RPA	Yes	Yes	Yes	Possibly	Review of EIS only
Southwestern CT RPA	Yes	Yes			
CT. Dept. of Transporatation	Yes	Yes, severity contingent upon quantity & quality of material	Some cases	Gold Star Bridge @ east back of Thames River	Subject to CT DEP & Corps of Engrs' review
New Haven Terminal	Yes	Yes	Yes	Unknown	None

TABLE V-16

...at is ...nature and ...t of your ...ty in relation ...his concept?	Would you consider sponsoring a DMCF project if Federal funds were available?	Would you consider sponsorship if 100% Federal funding is not possible? If so, what are your financial capabilities?	Are any changes expected in your authority or financial capability which would affect the implementation of a plan?	Currently, are there any programs, policies or development plans with which a containment plan could be coordinated?	Are there any possible constraints or impediments which should be considered before a plan is implemented?	How would you like the containment area used after it is filled and completed?	Who would be responsible for managing and maintaining it after completion?
...Executive ...r of ...ipality	Yes	Yes, limited capabilities.	No	Only harbor dredging.	CAM & DEP*	Open & recreation.	Guilford
...(presents it ...ty Council)	Yes	Depends on need for dredging	No	None Known	None Known	Open-Minded	City
...n	Yes	Yes, limited	yes, other commitments	CAM	Ultimate management	Depends on location & character	Public entity funded by users
...ipal Gov't	May be an attractive offer	No	No	No	Yes, local approval of materials to be deposited & review procedure to ensure safe handling	Passive recreation or marinas	Joint State & local
...w & comment ...rmits, CAM	Yes	Maybe	No	CAM, Thames River Development Corp.	Yes	Wildlife or recreation	State
...	No	No, should be Corps of Engrs or CT DEP	No	None	Short & long term effects of beaches, shoreline erosion or siltation	Wildlife sanctuary & educational studies	CT DEP, University of CT @ Avery Pt.
...owns adjacent ...rty	Yes	Yes, jointly w/Bureau of Outdoor Recreatio	Possibly	CAM, Tidal Wetlands	Effects of tidal wetlands, recreation & navigation	Recreation	Owner of new land & Corps of Engrs.
..., unless above ...r attached to ... Regulate ...elands.	Yes	?	No	CAM	Location	Probably parking or recreation	Probably CT DEP
...r improvement ...y of Milford	Yes	Not authorized to make expenditures. Seek municipal funding.	No	Flood & Erosion Control Board	Cooperation of shorefront property owners	Passive Recreation	Milford DPW
...re & present ...ing programs ...lectmen & ...Meeting	Yes	Yes, but unknown if full funding would be considered.	No	Shore erosion prevention, expand beach & park, recreation & wildlife	Environmental Impacts	Beach pky. & playground expansion, breakwater construction, wildlife refuge	Marina Commission, Park & Recreation Dept.
...wide ...ing, general ...ptual, ...ation- ...ted uses.	Beyond this agency's scope	None	No	See Question 4	Environmental, locational, economic, etc.	Recreation	Town or State
...w of EIS only	No authority	See Question 6	No	CAM	Environmental	Variety of uses seem possible	Depends on use
	Planning agency - not operating	None	No	Municipal plans, harbor development plans, Conservation Comm., RPA	Coastal residents, protect shellfish	Wildlife refuges, public recreation	Public or non-profit organization (regional land trust)
...ct to CT DEP ...rps of Engrs' ...w	Yes an application pending	Yes, State funds available	No	New London's CAM Program, State or private firm interested in new land.	Environmental factors, construction & maintenance costs.	Commerical, in conjunction with the channel	Those receiving direct economic benefits
	No	No	No	No	Unknown	Parks	Structural maintenance by Corps Management by local gov't.

2-

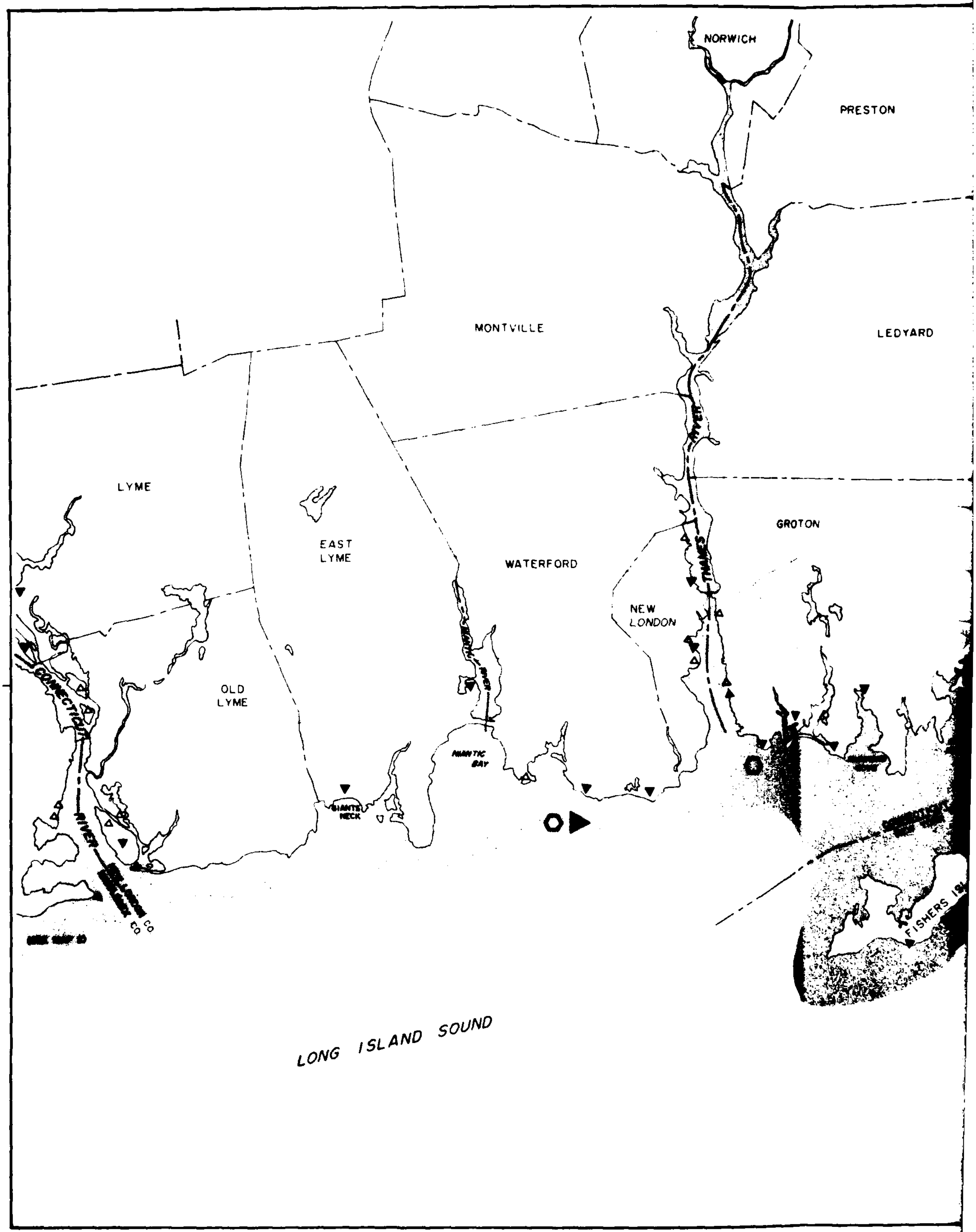
Questions:	Is there interest in continued dredging of rivers & harbors?	Is disposal of dredged material a problem or potential problem?	Is dredged material containment a potentially acceptable alternative?	Where are potential DMCF sites which would be useful to you?	What is the nature and extent of your authority in rela[tion] to this conce[rn]
Institutions:					
Clinton Waterfront Assoc.	Yes	Current problem	Yes	Local to Clinton	An association [o]f marina owners
Cedar Island Marina (Clinton)	Absolutely Yes	Current serious problem	Yes	Off Hammonassett or near Clinton (within pumping distance)	Marina owner - dredging 17,000 cy/year
Harbor Marine Center, Inc. (Cos Cob)	Yes	Yes	Yes	Area between Great Captain's Island & Little Captain's Island	Referred survey [to] Parks & Recreation, Greenwich
Long Term Planning Comm. Downtown Merchants Assoc. (Westport)	Yes	Yes	Possibly	Adjoining Parker Harding parking area in Westport	Comm. studying alt's for expand[-]ing parking area[,] adding new road bypass, and larg[e] park area.
CT Municipal Electric Energy Cooperative (Groton)	Not applicable	-	-	-	-
Mount Vernon, NY	Yes	Yes	Yes	-	-
Dept. of Ports & Terminals New York City, NY	Absolute Necessity	Serious problem due to PCB contamination	Containment facilities must prevent leaching of contaminants	No available sites have been identified	Jurisdiction ov[er] several miles o[f] waterfront properties
Port Chester, NY	Yes	Yes	Yes	Problem is that we have no sites	Own municipal waterfront whic[h] currently needs dredging
New Rochelle, NY	Sent copy of City Council Resolution #240	-	-	-	-
Shelter Island, NY	Creeks & Inlets - Yes	Not locally, only if material from elsewhere were brought to our island	Not for other peoples' materials	We handle our own & expect others to do likewise	Town Supervisor
LI Regional Planning Board, NY	Sent copy of Comprehensive Dredging Subplan for Nassau and Suffolk Counties			-	-
County of Nassau DPW NY	Many areas where dredging is necessary	Disposal has becme an increasingly difficult task	Depending upon location - potentially acceptable	County park bordering Hempstead Harbor if benefits to community were sufficient	Eng'g function [as] it relates to design & develo[p]ment of a futu[re] county facility
Suffolk County DPW, NY	Yes	Yes	Yes	Inner bays - between Mainland & Barrier Beach on south side of Suffolk County	Propose & subm[it] projects

*CAM - Coastal Area Management
DEP - Department of Environmental Protection

TABLE V-16 (cont.)

What is [the] nature and [ext]ent of your [auth]ority in relation [to] this concept?	Would you consider sponsoring a DMCF project if Federal funds were available?	Would you consider sponsorship if 100% Federal funding is not possible? If so, what are your financial capabilities?	Are any changes expected in your authority or financial capability which would affect the implementation of a plan?	Currently, are there any programs, policies or development plans with which a containment plan could be coordinated?	Are there any possible constraints or impediments which should be considered before a plan is implemented?	How would you like the containment area used after it is filled and completed?	Who would be responsible for managing and maintaining it after completion?
ssociation of na owners	Yes	Maybe	No	Yes, improvement & maintenance of our harbor	No	In whatever way would satisfy DEP & local residents	Whoever has use of it
na owner - ging 17,000 ear	Yes	Yes, depends on accessibility of site (how close it is). How long a life span it would have	No	Maintenance dredging & possible improvement projects	Nc	Don't care	1. Who ever has use of it. 2. Otherwise a fee could be charged to those discharging material into it for a fund to support future maintenance.
rred survey to s & Recrea- n, Greenwich	-	-	-	-	-	-	-
. studying 's for expand- parking area, ing new road ses, and large area	Yes	Have considered a fund raising campaign for the purpose	No	Yes	Possible opposition from segment of public	See #5	Town of Westport
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
sdiction over eral miles of erfront perties	Yes	Non-Federal dredging amounts to 3 million cubic yards per year. The cost of such dredging and disposal of sediments is paid for by private industry and/or the appropriate agency.			The use of any newly created land would be dictated by its location and the extent to which the land could support structures. The Federal gov't should be responsible for managing and maintaining the facility.		
municipal erfront which rently needs dging	Yes, but we have no sites	Yes - None	-	No	-	-	-
	-	-	-	-	-	-	-
n Supervisor	No	No	No	No	We don't want one	We don't want one	We don't want one
-	-	-	-	-	-	-	-
's function as relates to ign & develop- t of a future nty facility	Yes - If developmental benefits accrued with or without Federal funds	See #6 - Too speculative for response at this time	Question not clear	Should be discussed w/the Nassau Co. Dept. of Recreation and Parks	En[vironm]ental hearings, objections, & overlapping gov't jurisdiction.	Parks, lands, athletic fields & restoration of mined-out, unsightly land.	Dept. of Recreation & Parks
pose & submit jects	Yes		Yes, limited funding available for individual projects if cost is reasonable	Funding changes each fiscal year depending on overall county budget	Various small projects which could prossibly be designed for use w/a containment plan.	Pratical & economic limits of dredges & season	Should be determined by local municipalities	Owner of area

2


NORWICH
PRESTON
MONTVILLE
LEDYARD
LYME
EAST
LYME
WATERFORD
GROTON
NEW
LONDON
OLD
LYME
THAMES
RIVER
CONNECTICUT
RIVER
NIANTIC
BAY
GIANTS
NECK
FISHERS IS
LONG ISLAND SOUND

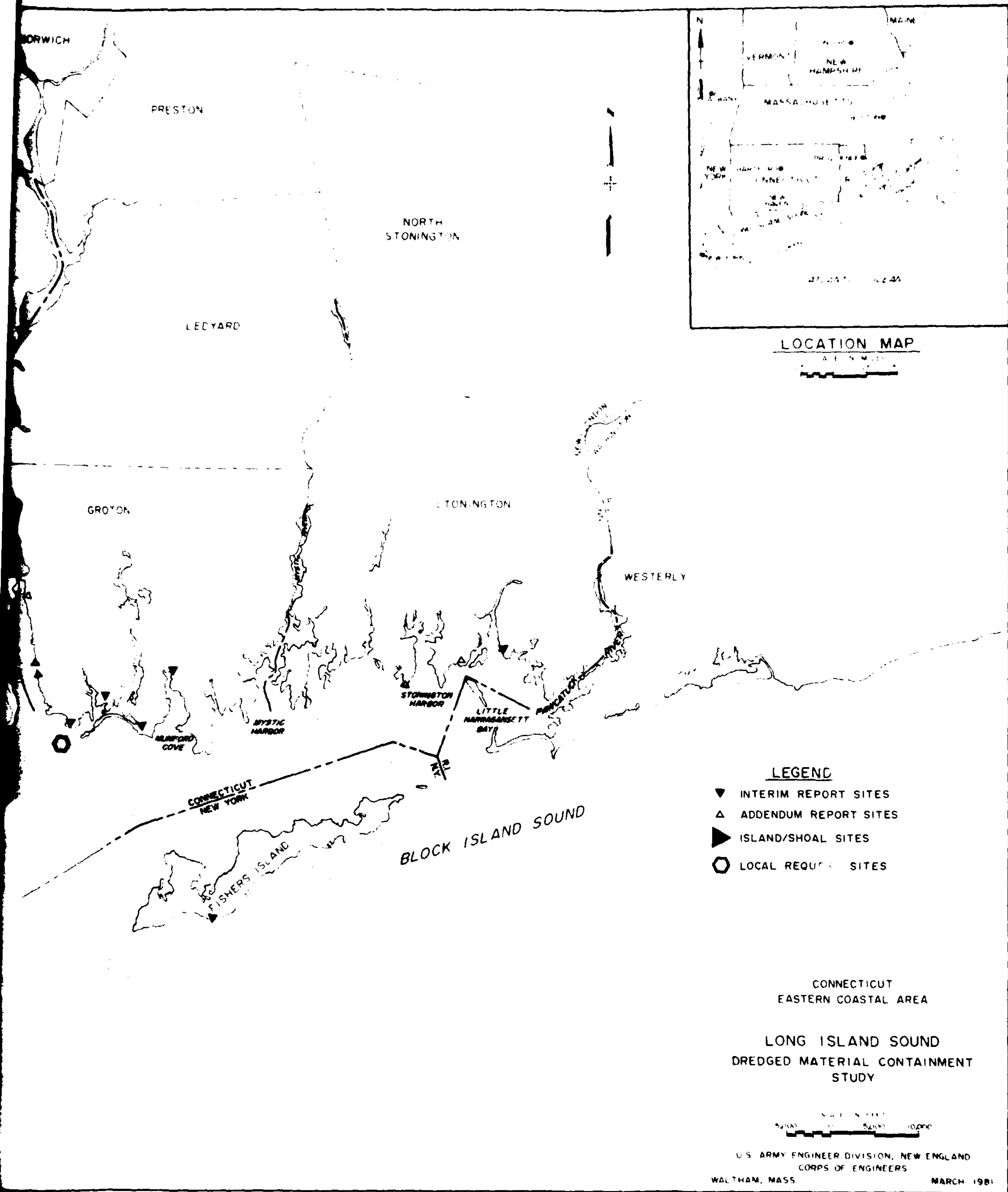
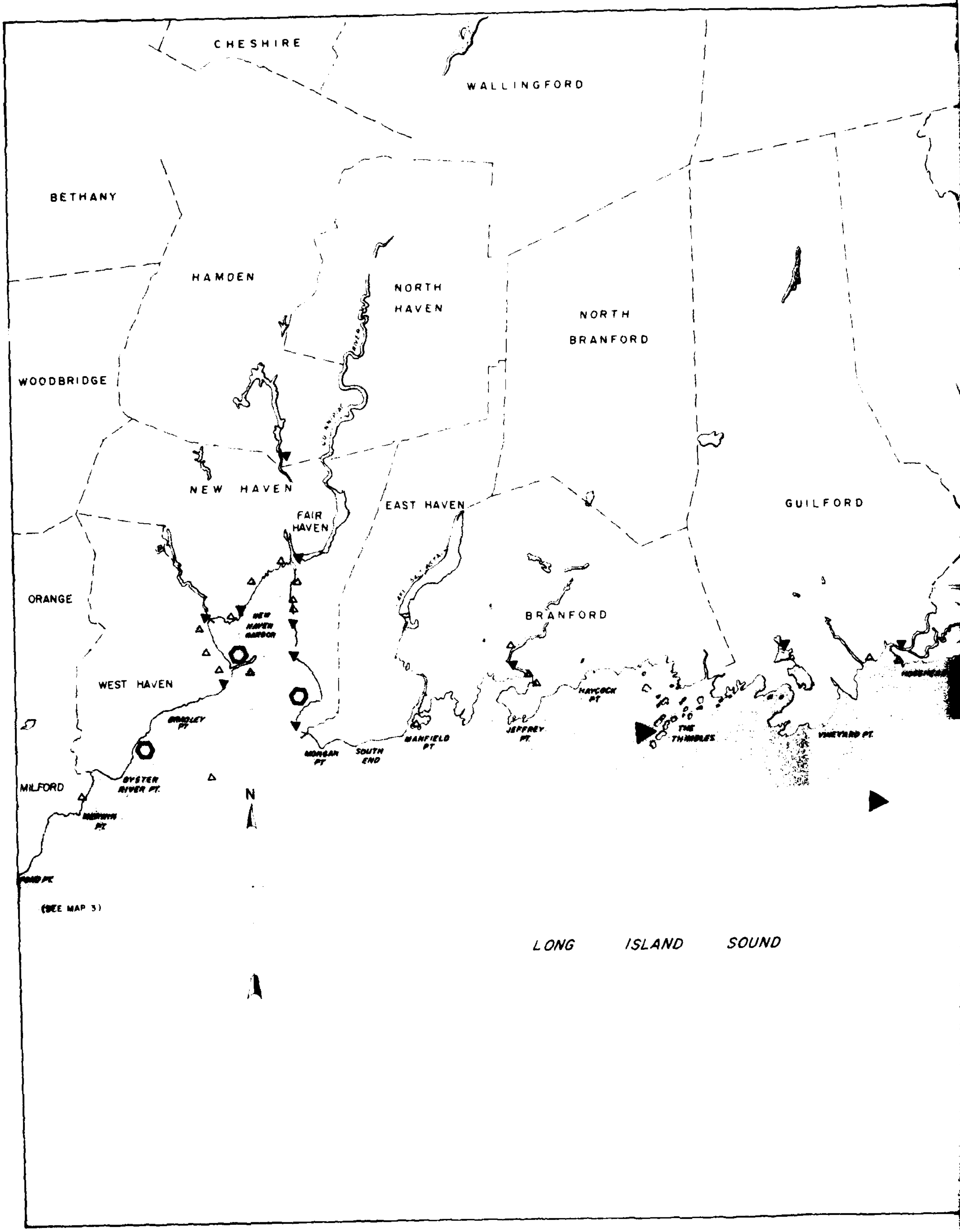

NORWICH
PRESTON
NORTH STONINGTON
LEDYARD
GROTON
STONINGTON
WESTERLY
MYSTIC HARBOR
MUMFORD COVE
STONINGTON HARBOR
LITTLE NARRAGANSETT BAY
PAWCATUCK RIVER
CONNECTICUT
NEW YORK
R.I.
N.Y.
BLOCK ISLAND SOUND
FISHERS ISLAND
LOCATION MAP
VERMONT
NEW HAMPSHIRE
MAINE
NEW YORK
CONNECTICUT
LEGEND
INTERIM REPORT SITES
ADDENDUM REPORT SITES
ISLAND/SHOAL SITES
LOCAL REQU SITES
CONNECTICUT
EASTERN COASTAL AREA
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
MARCH 1981

PLATE V-2


CHESHIRE
WALLINGFORD
BETHANY
HAMDEN
NORTH HAVEN
NORTH BRANFORD
WOODBRIDGE
NEW HAVEN
FAIR HAVEN
EAST HAVEN
GUILFORD
ORANGE
BRANFORD
NEW HAVEN HARBOR
WEST HAVEN
BRADLEY PT.
HAYCOCK PT.
JEFFREY PT.
MANSFIELD PT.
MORGAN PT.
SOUTH END
THE THIMBLES
VINEYARD PT.
OYSTER RIVER PT.
MILFORD
N
(SEE MAP 3)
LONG ISLAND SOUND

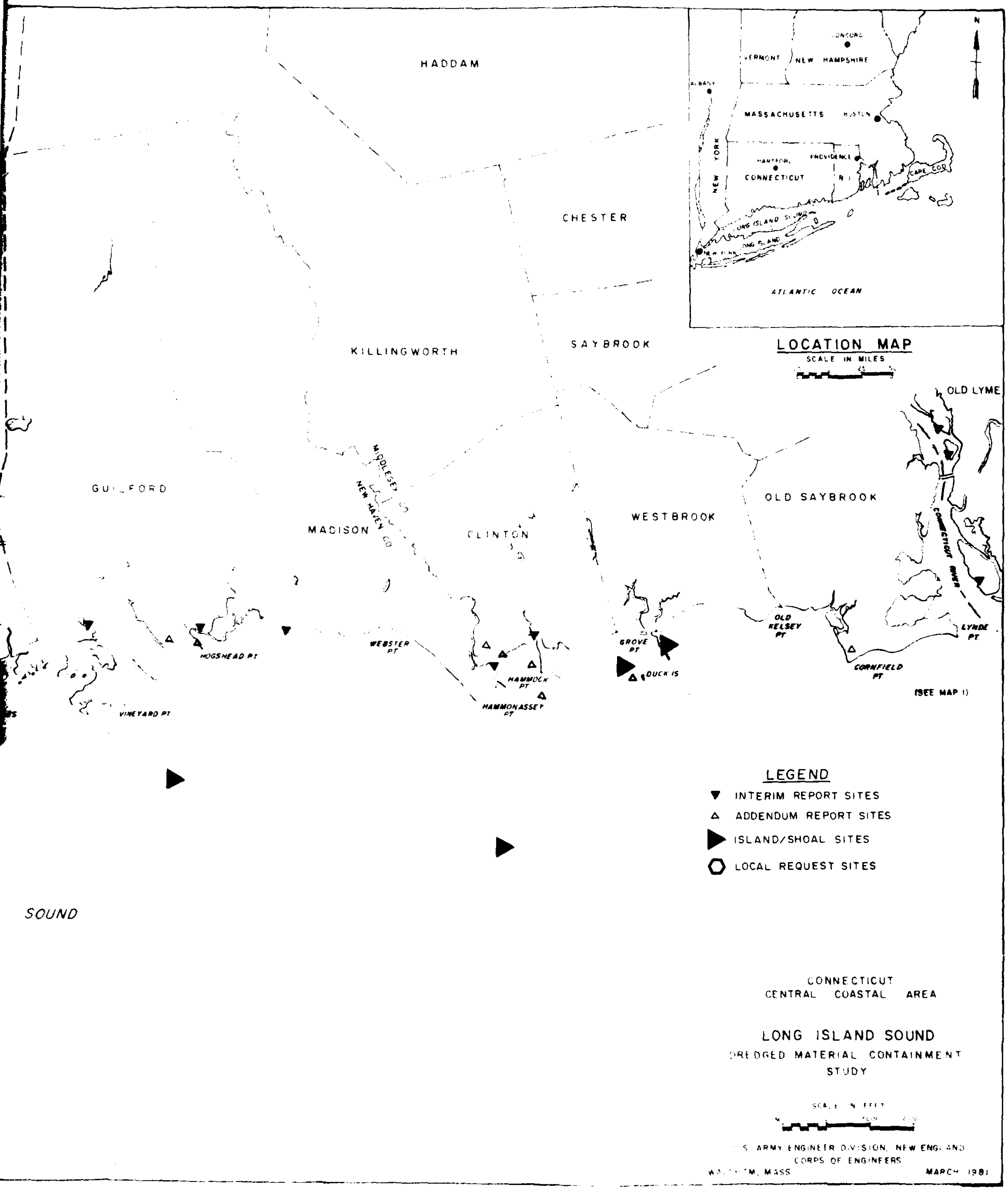
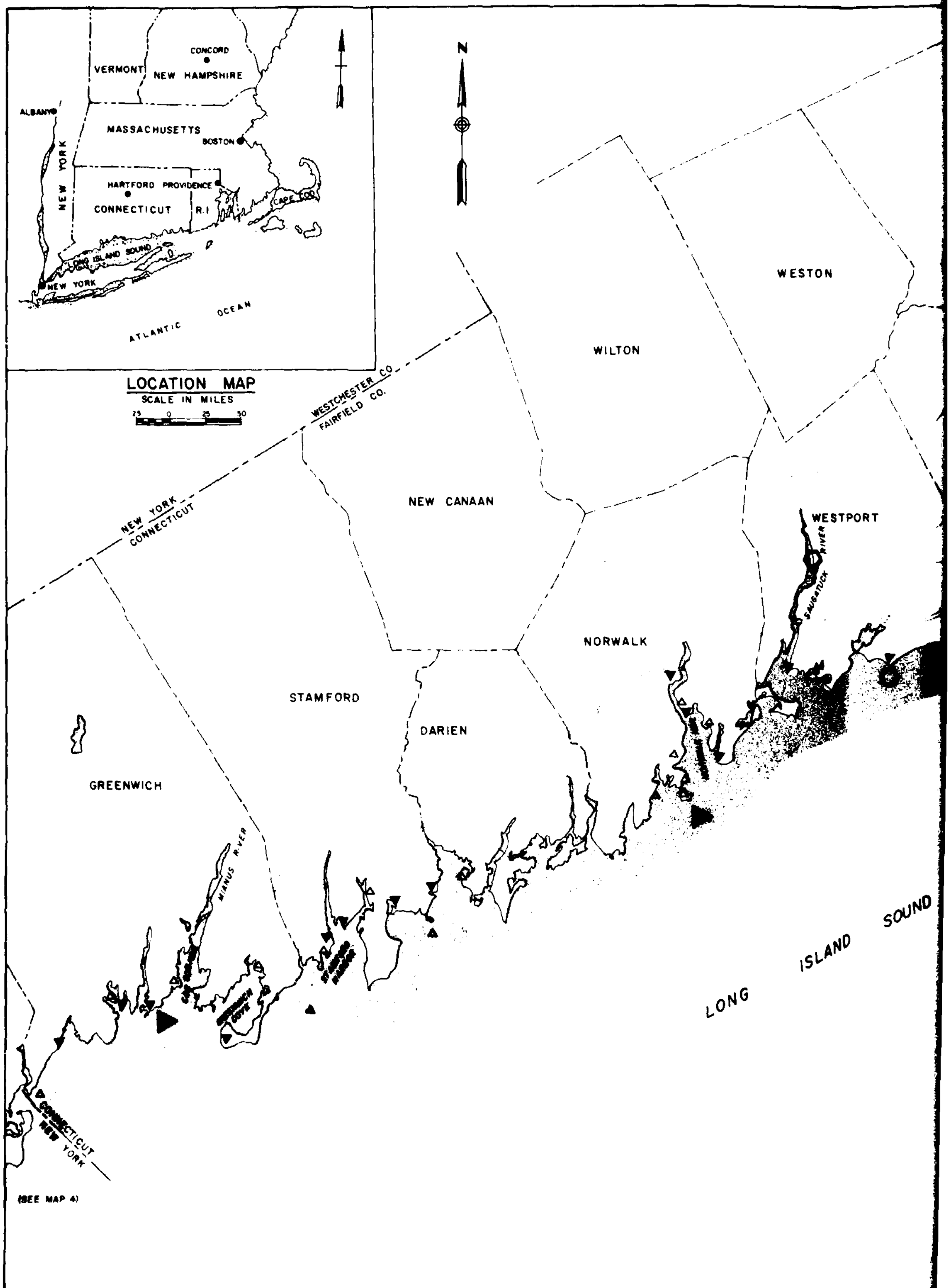

HADDAM
CHESTER
KILLINGWORTH
SAYBROOK
GUILFORD
MADISON
CLINTON
WESTBROOK
OLD SAYBROOK
OLD LYME
MIDDLESEX CO
NEW HAVEN CO
CONNECTICUT RIVER
HOGSHEAD PT
VINEYARD PT
WEBSTER PT
HAMMOCK PT
HAMMONASSET PT
GROVE PT
DUCK IS
OLD KELSEY PT
CORNFIELD PT
LYNDE PT
(SEE MAP 1)
SOUND
LOCATION MAP
SCALE IN MILES
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
NEW YORK
PROVIDENCE
CAPE COD
ATLANTIC OCEAN
LEGEND
INTERIM REPORT SITES
ADDENDUM REPORT SITES
ISLAND/SHOAL SITES
LOCAL REQUEST SITES
CONNECTICUT
CENTRAL COASTAL AREA
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
CORPS OF ENGINEERS
MARCH 1981

PLATE V-3


LOCATION MAP
SCALE IN MILES
25 0 25 50
VERMONT
NEW HAMPSHIRE
CONCORD
ALBANY
MASSACHUSETTS
BOSTON
NEW YORK
HARTFORD
PROVIDENCE
CONNECTICUT
R.I.
CAPE COD
LONG ISLAND SOUND
NEW YORK
ATLANTIC OCEAN
N
WESTCHESTER CO.
FAIRFIELD CO.
NEW YORK
CONNECTICUT
WESTON
WILTON
NEW CANAAN
WESTPORT
SAUGATUCK RIVER
NORWALK
STAMFORD
DARIEN
GREENWICH
MIANUS RIVER
LONG ISLAND SOUND
CONNECTICUT
NEW YORK
(SEE MAP 4)

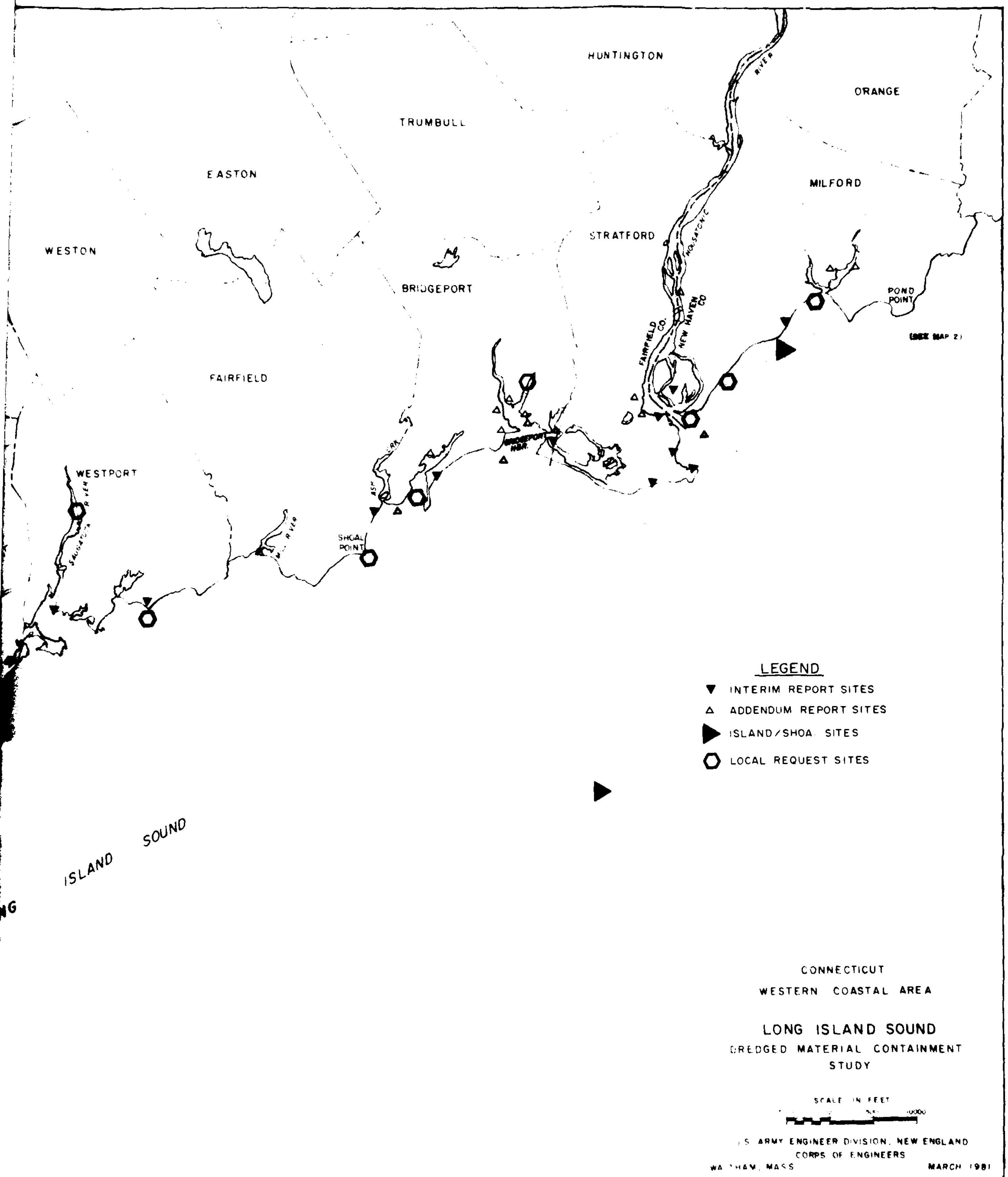
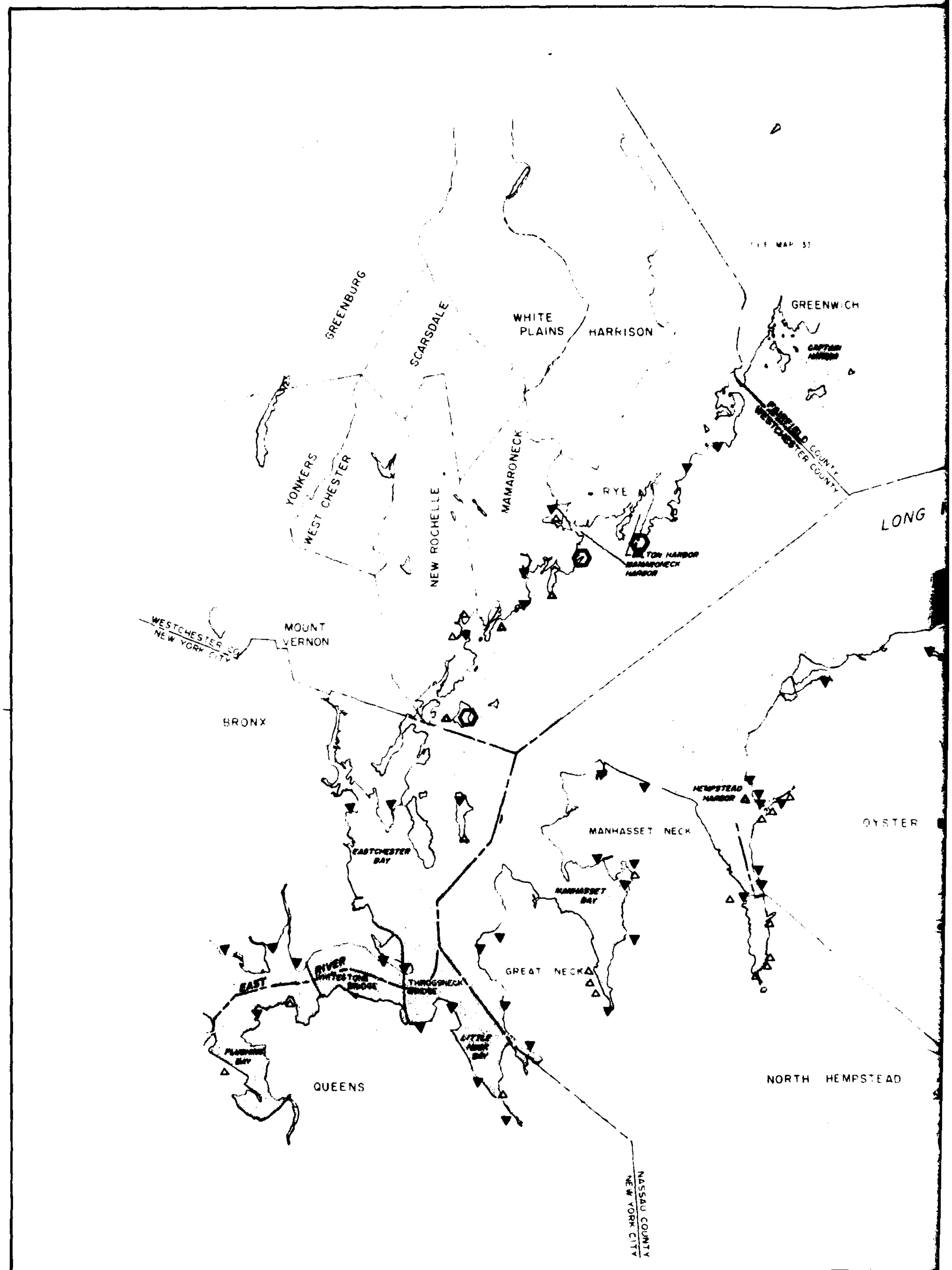

HUNTINGTON
ORANGE
TRUMBULL
EASTON
MILFORD
STRATFORD
WESTON
BRIDGEPORT
POND POINT
FAIRFIELD
WESTPORT
SHOAL POINT
ISLAND SOUND
LEGEND
INTERIM REPORT SITES
ADDENDUM REPORT SITES
ISLAND/SHOA SITES
LOCAL REQUEST SITES
CONNECTICUT
WESTERN COASTAL AREA
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
SCALE IN FEET
CORPS OF ENGINEERS
MARCH 1981

PLATE V-4

2


GREENBURG
SCARSDALE
WHITE PLAINS
HARRISON
GREENWICH
FAIRFIELD COUNTY
WESTCHESTER COUNTY
YONKERS
WEST CHESTER
NEW ROCHELLE
MAMARONECK
RYE
LONG
MAMARONECK HARBOR
MOUNT VERNON
WESTCHESTER CO.
NEW YORK CITY
BRONX
MANHASSET NECK
HEMPSTEAD HARBOR
OYSTER
EASTCHESTER BAY
MANHASSET BAY
EAST RIVER
WHITESTONE BRIDGE
THROGSNECK BRIDGE
GREAT NECK
LITTLE NECK BAY
FLUSHING BAY
QUEENS
NORTH HEMPSTEAD
NASSAU COUNTY
NEW YORK CITY

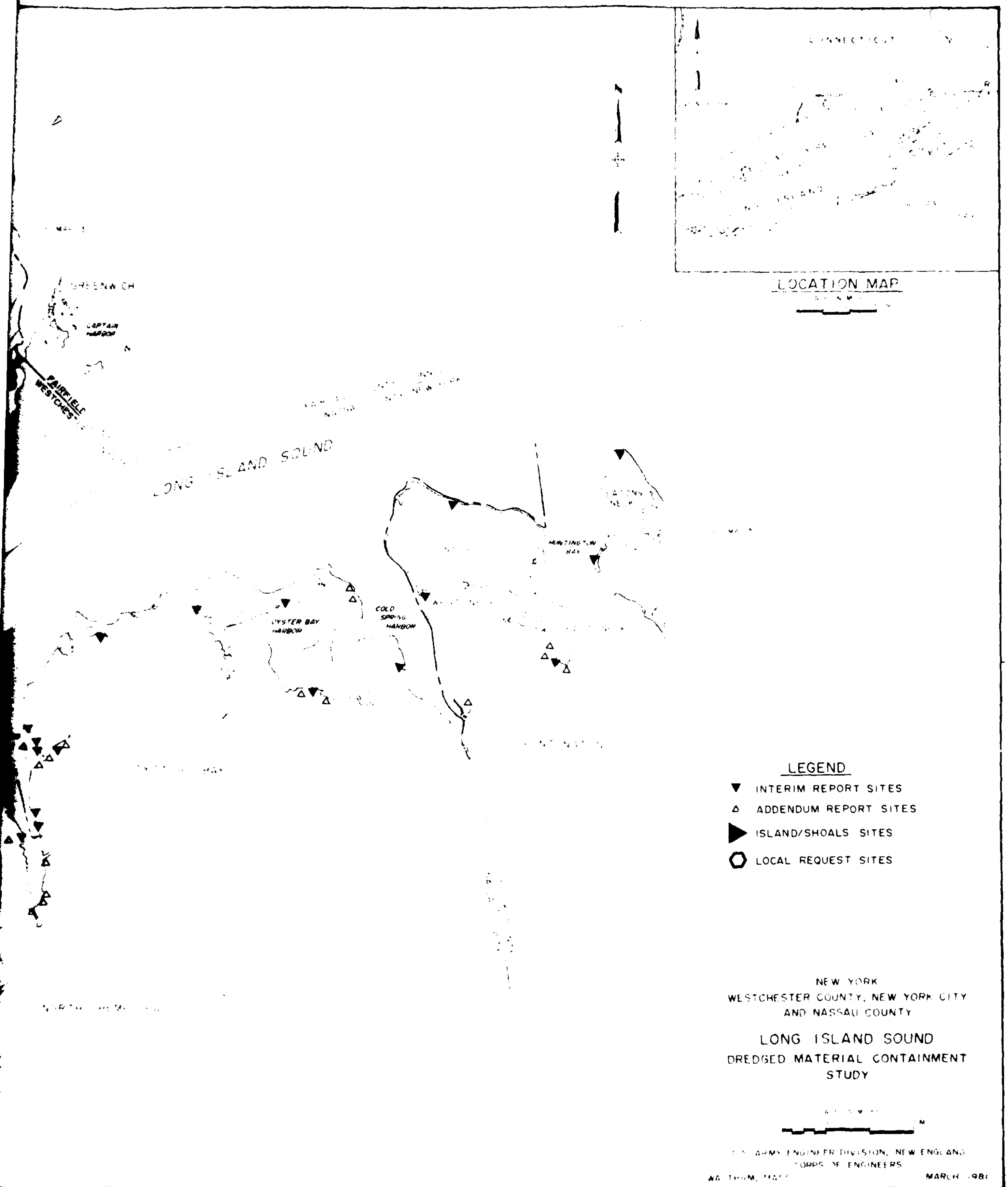
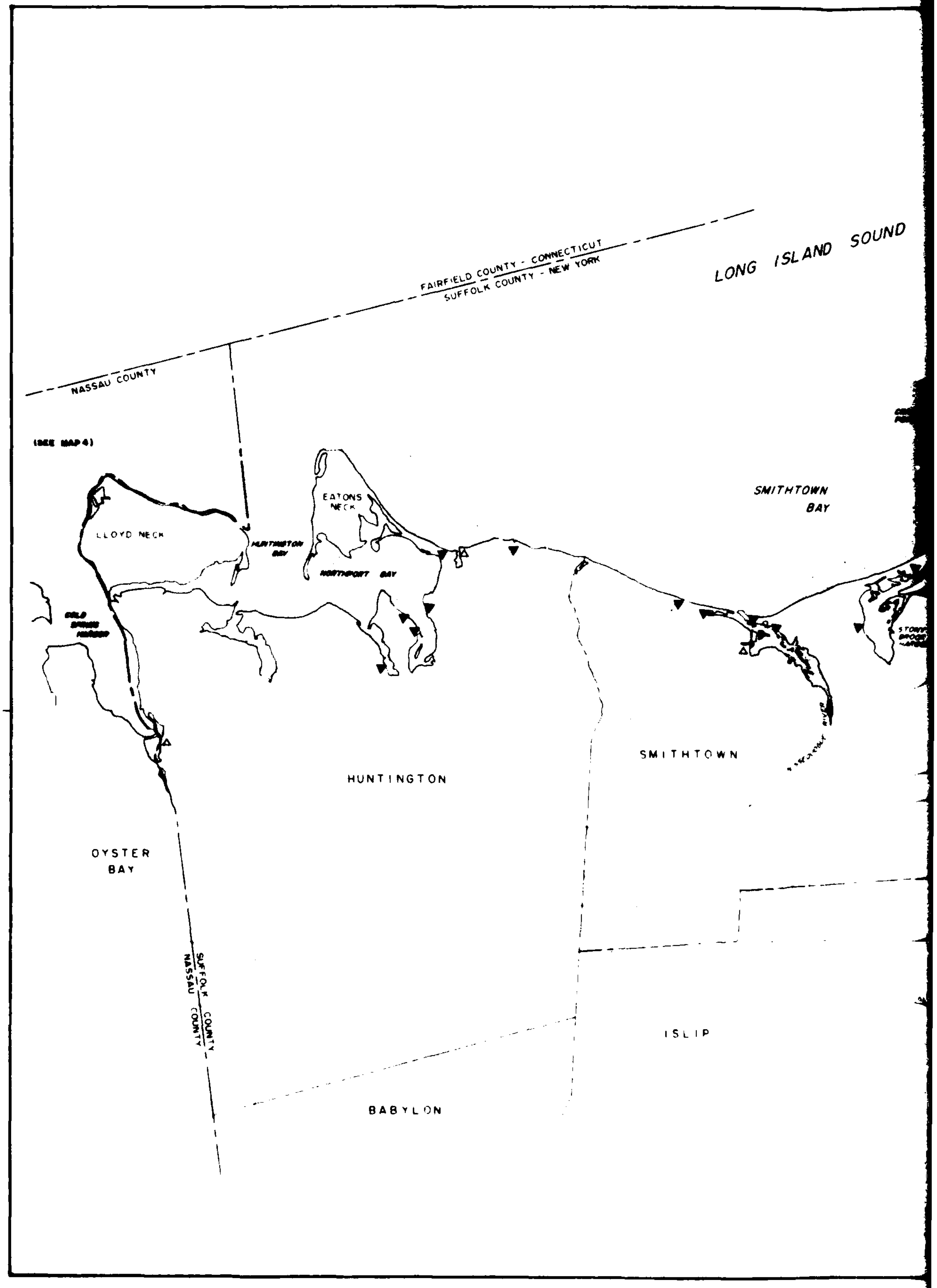

LOCATION MAP
GREENWICH
CAPTAIN HARBOR
FAIRFIELD
WESTCHESTER
LONG ISLAND SOUND
HUNTINGTON BAY
OYSTER BAY HARBOR
COLD SPRING HARBOR
LEGEND
INTERIM REPORT SITES
ADDENDUM REPORT SITES
ISLAND/SHOALS SITES
LOCAL REQUEST SITES
NEW YORK
WESTCHESTER COUNTY, NEW YORK CITY
AND NASSAU COUNTY
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
CORPS OF ENGINEERS
MARCH 1981

PLATE V-5

2


LONG ISLAND SOUND
FAIRFIELD COUNTY - CONNECTICUT
SUFFOLK COUNTY - NEW YORK
NASSAU COUNTY
(SEE MAP 4)
EATONS NECK
LLOYD NECK
SMITHTOWN BAY
SMITHTOWN
HUNTINGTON
OYSTER BAY
SUFFOLK COUNTY
NASSAU COUNTY
ISLIP
BABYLON

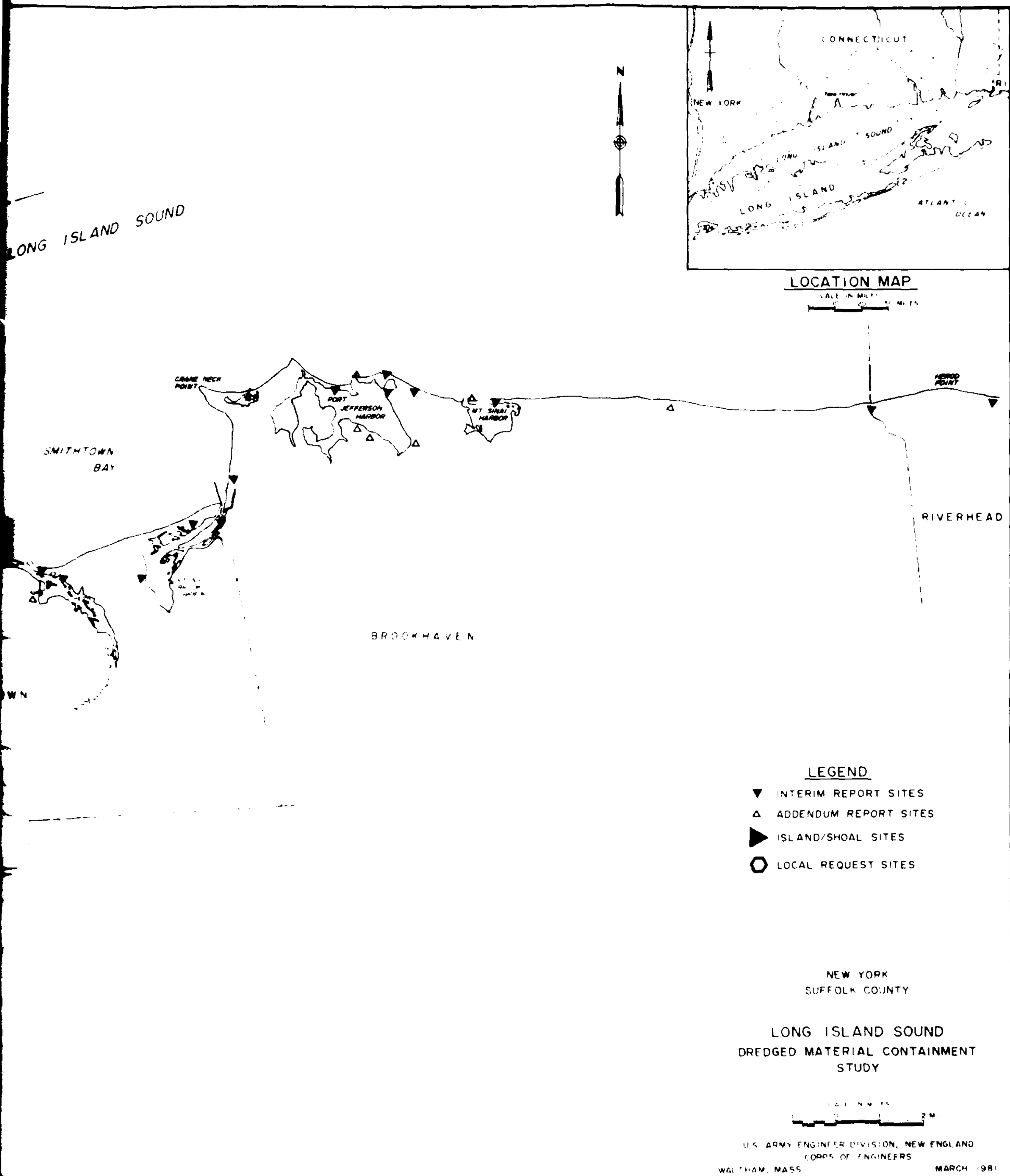
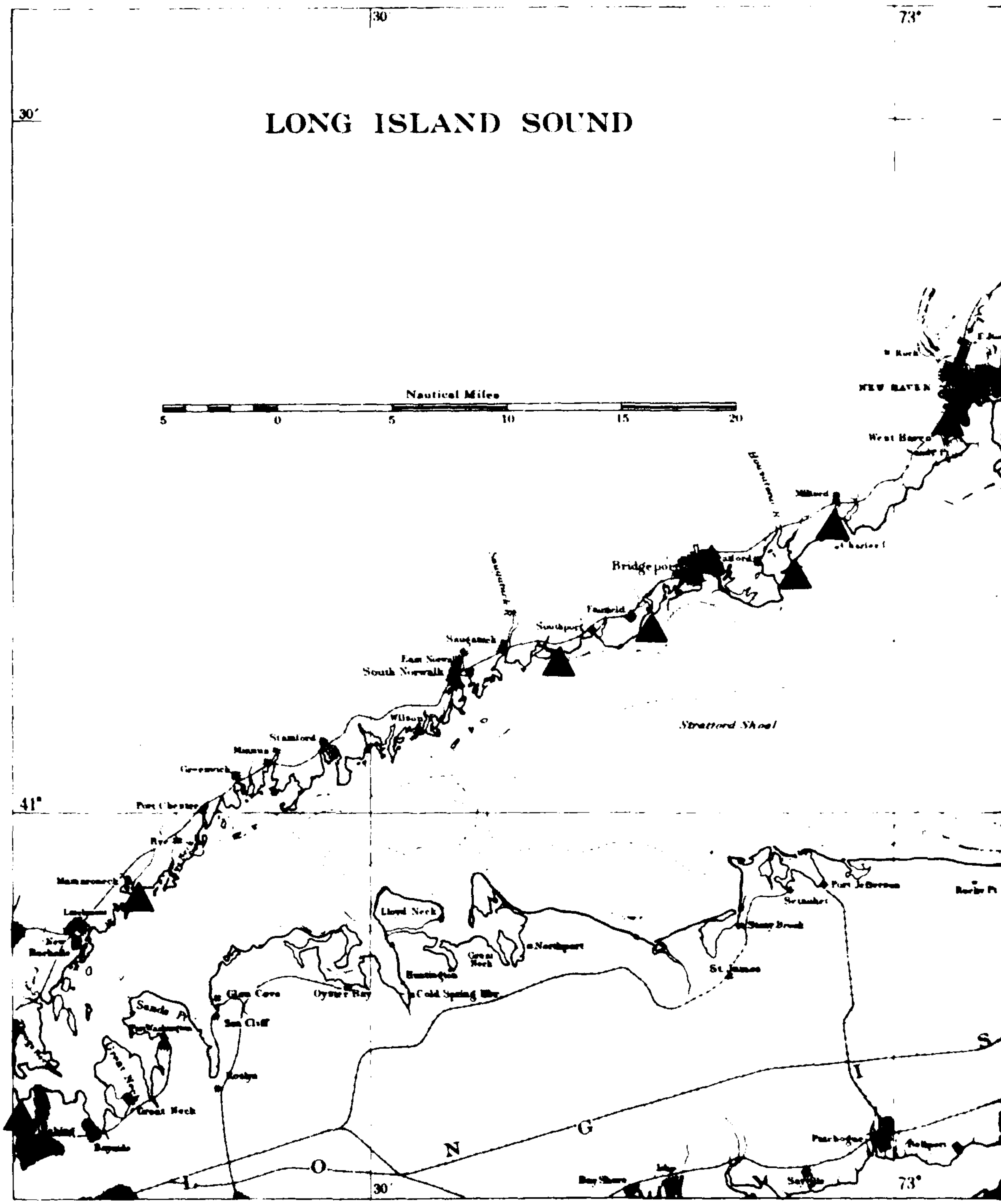
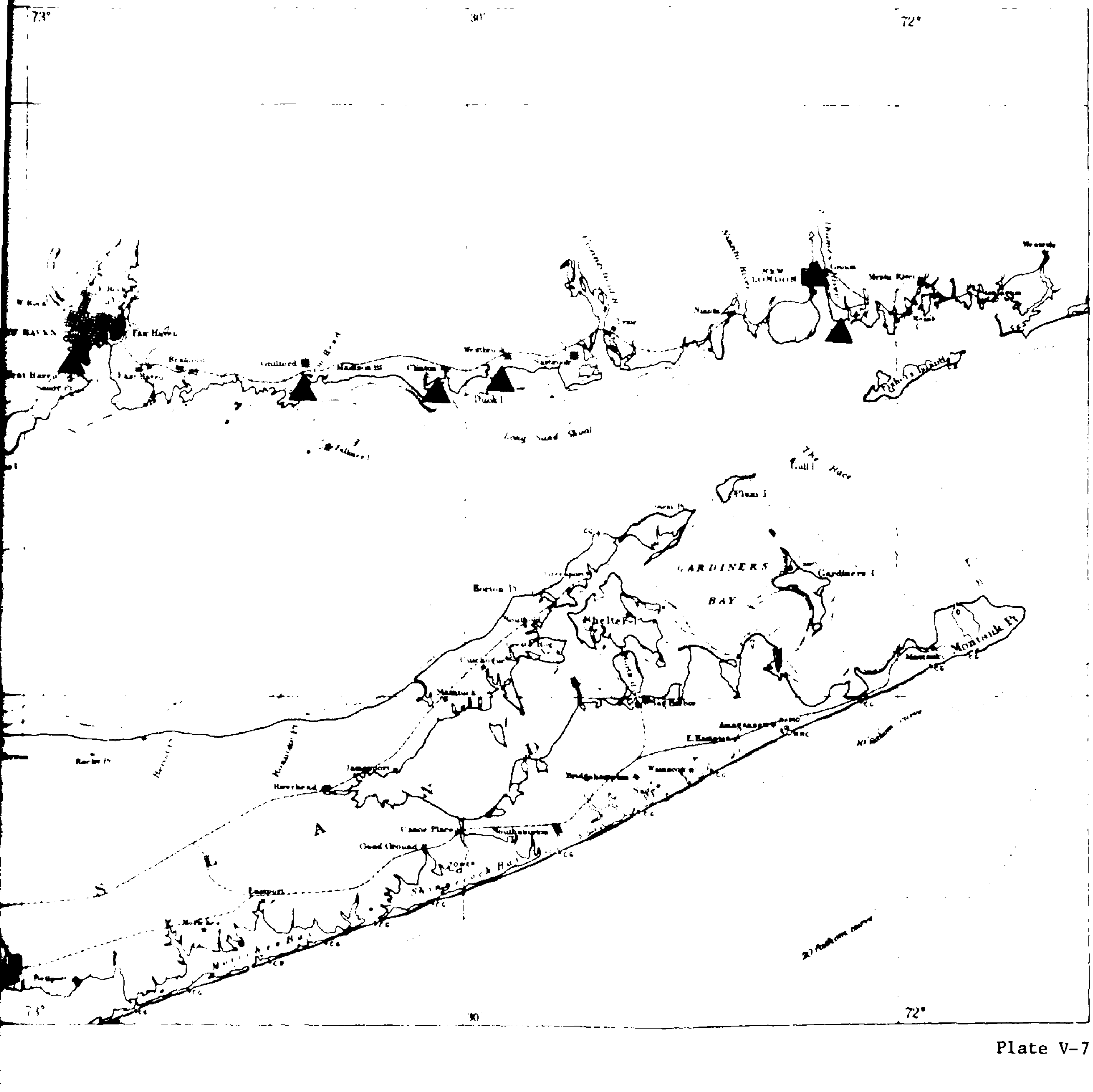

N
LONG ISLAND SOUND
CONNECTICUT
NEW YORK
LONG ISLAND SOUND
LONG ISLAND
ATLANTIC OCEAN
LOCATION MAP
CRANE NECK POINT
PORT JEFFERSON HARBOR
MT SINAI HARBOR
HEROD POINT
SMITHTOWN BAY
RIVERHEAD
BROOKHAVEN
LEGEND
INTERIM REPORT SITES
ADDENDUM REPORT SITES
ISLAND/SHOAL SITES
LOCAL REQUEST SITES
NEW YORK
SUFFOLK COUNTY
LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT
STUDY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
MARCH 1981

PLATE V-6


LONG ISLAND SOUND
Nautical Miles
5
0
5
10
15
20
30
73°
30'
41°
NEW HAVEN
Bridgeport
South Norwalk
Stamford
Southport
Stratford Shoal
Lloyd Neck
Huntington
Northport
Glen Cove
Oyster Bay
Cold Spring Hbr.
Port Jefferson
St. James
Bay Shore
Sayville
L
O
N
G
I
S
73°
30'



73°
30'
72°
NEW LONDON
Fair Haven
Guilford
Madison
Long Sand Shoal
The Race
Plum I
GARDINERS
BAY
Gardiners I
Montauk Pt
Riverhead
Southampton
Good Ground
Canoe Place
Bridgehampton
E Hampton
Amagansett
Montauk
Sag Harbor
Orient Pt
Greenport
Shelter I
Mattituck
Jamesport
Horton Pt
Bellport
20 fathom curve
30 fathom curve
73°
30
72°

Plate V-7

The following four reports represent the results of individual studies conducted in conjunction with the overall Long Island Sound Dredged Material Containment Study. Each report is complete within itself. In the main report reference has been made to each of these separate items. The reports included are:

- Environmental Assessment of Prototype Marsh Creation and Containment Facility Sites (This particular report summarizes portions of eight work items performed specifically or in part by the LIS-DMCS).
- Social Considerations (This report summarizes in part three individual work items performed during the study effort).
- Prototype Report - Geotechnical Engineering Branch - Geotechnical investigations for Clinton Harbor and Black Ledge.
- Site Screening Report - Geotechnical Engineering Branch - Preliminary geotechnical analysis at five sites.

ENVIRONMENTAL ASSESSMENT

OF PROTOTYPE MARSH

CREATION AND CONTAINMENT FACILITY SITES

<u>LONG ISLAND SOUND</u>

<u>DREDGED MATERIAL</u>

<u>CONTAINMENT STUDY</u>

OCTOBER 1982

NEW ENGLAND DIVISION
U. S. ARMY CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

SUMMARY - PROTOTYPE SITE EVALUATIONS

Long Island Sound is a unique salt water resource involving about 1,400 square miles of water surface and 1,000 miles of coastline. The Sound is bounded on the north by Connecticut, on the south and west by Long Island and metropolitan New York, and on the east by the Atlantic Ocean and among many of its uses, serves as a waterway for commercial deep-draft navigation. This study considers the feasibility and impacts of using dredged materials from the maintenance and deepening of harbors situated along Long Island Sound to build artificial islands for recreation, conservation, marsh building, development and other purposes. The study also investigates the utilization of dredged materials for non-Federal projects and the feasibility and acceptability of utilizng solid wastes other than dredged materials for island building. The Federal Government has constructed deep-draft harbors at New London, New Haven and Bridgeport, Connecticut, at which over 17 million tons of commerce, chiefly fossil fuels, were handled in 1978. In addition to deep-draft commerce, there are a number of harbors which service extensive shellfish and finfish fleets. There are over thirty Federal navigation projects located along the Connecticut coast and ten along the New York sections of the Sound. In addition, there are many coastal areas that have been improved for navigation by local Government agencies. Many of these harbors have existing channels which periodically need dredging to remain at navigable levels. Stringent water pollution regulations, coastal wetlands restrictions, and shorefront developments have practically eliminated available areas for the disposal of dredged material. Local interests desire an alternative to the present conventional methods of disposal to provide for the continued maintenance and improvement of existing harbor facilities, recreational uses and economic development without degrading the water quality and other environmental factors of Long Island Sound. The scope of the study is to consider containment and productive usage of dredged material in Long Island Sound from contiguous harbors of the Connecticut and New York coasts.

The New England Division has initiated two "prototype" studies along the Connecticut coastline for detailed evaluation. The sites are: Clinton Harbor, which features a long dredged channel through tidal flats and shallows; and Black Ledge which is a rocky shoal located off New London Harbor.

As part of the feasibility studies, the baseline physical and biological conditions at each site was described. This was necessary to determine the most effective configuration of the facility, the potential for habitat creation versus commercial/industrial development, and the probable impact of the facility on the adjacent environment. It is also important to address the resource value of the new habitat relative to the displaced habitat and this has been done.

CLINTON HARBOR: The area west of the Federal Channel at Clinton Harbor is highly suited for marsh creation. Marsh creation at this site would expand the Hammonasset Marsh and provide continuity to the landscape. The area for marsh creation would follow the shoreline configuration and the seaward boundary shown in Figure 1. The area adjacent to the Federal Channel will remain open to provide the necessary tidal flow to sustain a marsh and support recreational and commerical boating. Section 150 of the Water Resources Development Act of 1976 gives special authority to the Army Corps of Engineers for construction of wetlands.

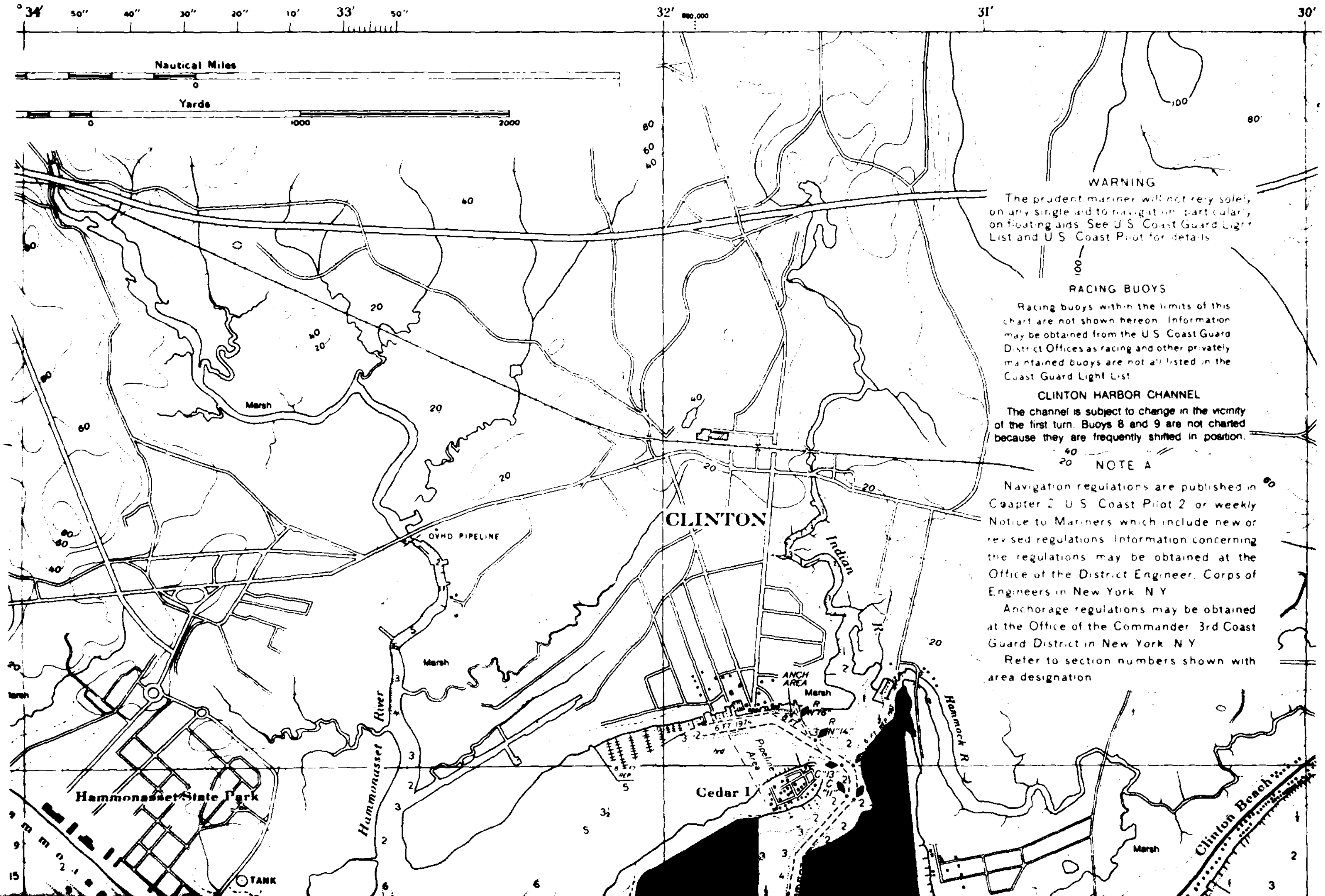
A man-made dike structure would be constructed in place along the seaward side of the proposed marsh site. A bulkhead protected with rock rip-rap would probably be the most suitable. The bulkhead should prevent the sediments from being lost during storms. The rip-rap should be put in place at an angle of 25^{o} to 35^{o}. The angle within this range would enable an intertidal and subtidal community of plants and animals to become established. The rip rap would also act as a buffer to storm waves, protecting the bulkhead and marsh.

The dredge material used for marsh creation would not be highly contaminated with man-made chemicals or metals from industrial processes but rather consist of Class I or II materials according to the NY-CT and New England River Basin Interim Plan criteria. The leaching of Class III substances into open water is recognized as a potential health hazard to man. Since these substances can be accumulated by some marine organisms that are utilized as food, they would not be used in any marsh creation project. The effluent from the containment area would be monitored to ensure the water quality will meet State and Federal requirements.

The importance of marshes as a habitat for juvenile fish, resting area for migratory birds, nesting areas for several species of shore birds, and as a source of detritus has been established. The ability of marshes to retard coastal erosion and to act as a storm buffer is also well known. Intertidal marshes along the coast of Connecticut have been reduced in area by the construction of homes, marinas and other structures.

The construction of a dredge material marsh would be beneficial. The feasibility of developing a biological marsh is one of the principal objectives of this study. The development of guidelines, specifications, and costs for site suitability and vegetation establishment has been achieved by using current-state-of-the-art methods for marsh creation that were developed for the U.S. Army Corps of Engineers and other published sources. An inspection of the site as well as an evaluation and impact assessment of the proposed marsh location on the adjacent Hammonasset State Park has been performed and the results are reported herein.

The habitat value of the Clinton Harbor and Bight proposed disposal site as a food resource in terms of benthic productivity, shellfish population densities, and finfish stomach content analysis has been


34' 50" 40" 30" 20" 10' 33' 50" 32' 31' 30'
Nautical Miles
Yards
0 1000 2000
WARNING
The prudent mariner will not rely solely on any single aid to navigation, particularly on floating aids. See U.S. Coast Guard Light List and U.S. Coast Pilot for details.
RACING BUOYS
Racing buoys within the limits of this chart are not shown hereon. Information may be obtained from the U.S. Coast Guard District Offices as racing and other privately maintained buoys are not all listed in the Coast Guard Light List.
CLINTON HARBOR CHANNEL
The channel is subject to change in the vicinity of the first turn. Buoys 8 and 9 are not charted because they are frequently shifted in position.
NOTE A
Navigation regulations are published in Chapter 2, U.S. Coast Pilot 2, or weekly Notice to Mariners which include new or revised regulations. Information concerning the regulations may be obtained at the Office of the District Engineer, Corps of Engineers in New York, N.Y.
Anchorage regulations may be obtained at the Office of the Commander, 3rd Coast Guard District in New York, N.Y.
Refer to section numbers shown with area designation.
CLINTON
Indian R
Hammock R
Clinton Beach
Hammonasset River
Hammonasset State Park
Cedar I
OVHD PIPELINE
Pipeline Area
ANCH AREA
Marsh
TANK

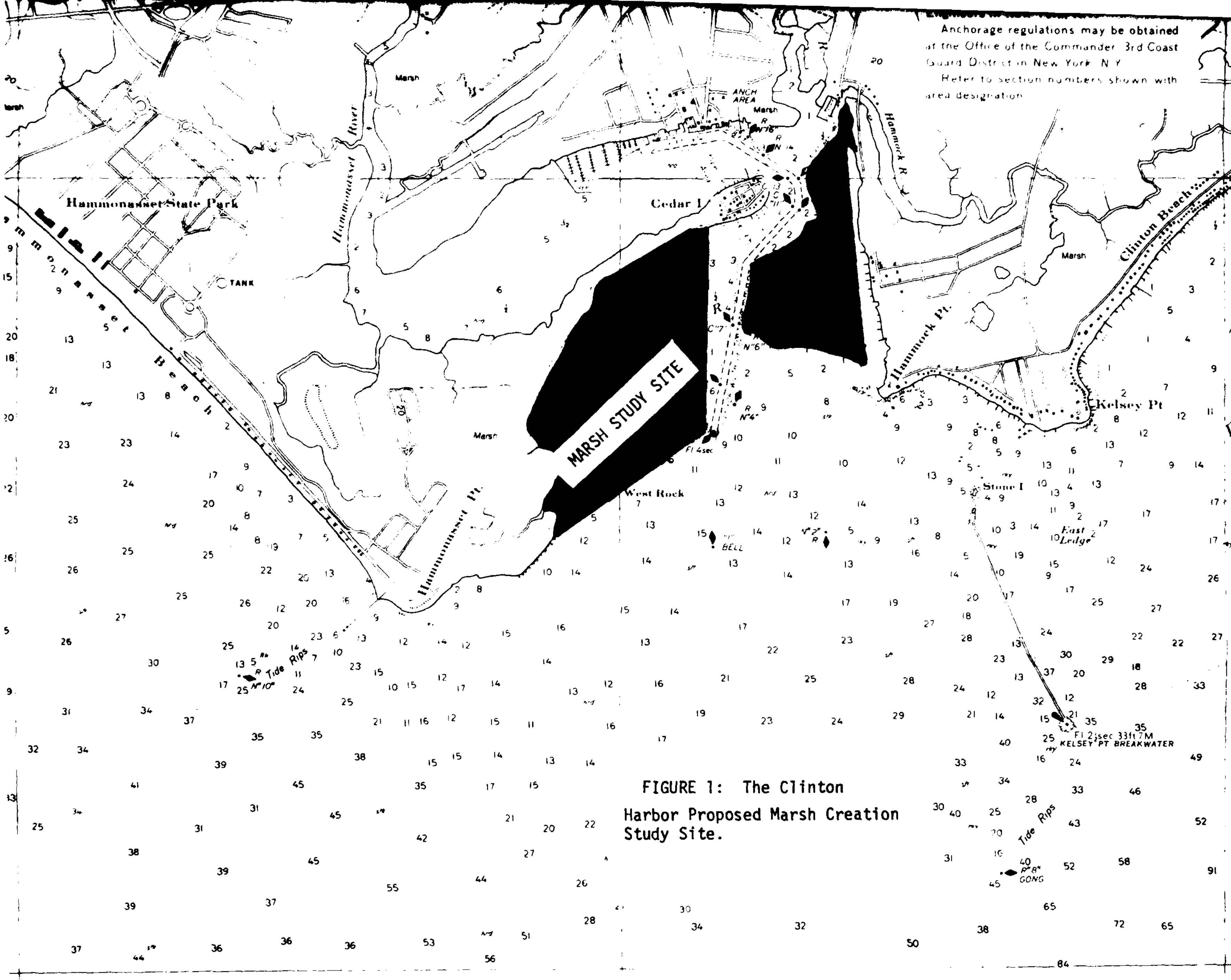


FIGURE 1: The Clinton Harbor Proposed Marsh Creation Study Site.

evaluated. The ecological "health" of the benthic environs were also evaluated employing a REMOTs sediment-water interface photographic imagery system. This survey method allows interpretation of physical and chemical characteristic of bottom sediments and its relationship to benthic species populations. Each component of the study, benthic productivity, shellfish population densities, and finfish stomach content analysis are discussed separately and then integrated to provide a preliminary assessment of the habitat. The data from each of the components listed above will be compared to similar studies that have been conducted in Long Island Sound and a comparative habitat ranking value established.

The present biological habitat value of the area proposed for the marsh creation is judged to be relatively low due to chronic physical disturbance. Most of the resident benthic communities in this area were in low order successional stages; this community type has the potential for high productivity if the frequency of disturbance is not too high. Secondary production estimates, based on standing stocks of dominant infaunal species, were found to be well below those documented in nearby strata with greater stability. Commercially valuable shellfish do not exist in numbers high enough to support anything beyond a very casual recreational, fishery.

The creation of the proposed marsh area could potentially increase the biological habitat value of the harbor complex through increased habitat diversity and enhanced productivity. In addition to the beneficial effects of the marsh, the proposed stone containment structure would greatly increase the subtrate available for hard-bottom communities in a manner and analyses to that documented for artificial reefs. The construction of a DMCF/marsh creation at this site, can only enhance the biological value of the area.

BLACK LEDGE. This site is located in shallow water off Avery Point, Groton, Connecticut and could be diked and filled with a variety of dredge material. The containment facility would be constructed in such a way that will restrict the loss of fine sediments. The structure should be high enough so that sediments are not washed out during storms (100 year storm wave heights). This site is envisioned to encompass an area of about 0.5 square miles and could accommodate approximately 6-8 million cubic yards while servicing the eastern Long Island Sound area.

Rock rip-rap would be placed along the outside perimeter of the containment structure at an angle of 35 degrees. The rip-rap would protect the containment facility from storm waves and also enable a community of plants and animals to colonize the rock surfaces. The open spaces between the rocks in the subtidal zone would also provide habitat space for lobsters and fish; this aspect has the potential of increasing the number of lobsters at Black Ledge as well as affecting and concentrating finfish.

Once the containment is filled and the contents compacted, it should be sealed (i.e., clay). A sufficient depth should remain so that an adequate space is available for clean fill (soil). Vegetation that can tolerate salt spray but not requiring tidal activity should be planted. The surface of the containment should have some relief, and not be a flat surface with vegetation.

In addition to serving as a controlled ecological educational studies facility and natural preserve, the facility could also provide some protection to the Groton shoreline. Depending on the type of materials placed in the confined area, the land created could also support light commercial or industrial development.

Some additional planning studies will be required upon completion of these two prototype studies should the results be favorably received by local interests and State and Federal regulatory agencies.

TABLE OF CONTENTS

FIGURES

TABLE

ENVIRONMENTAL ASSESSMENT

THE LONG ISLAND SOUND DREDGE MATERIAL DISPOSAL
CONTAINMENT AND ISLAND CREATION STUDY
PROTOTYPE SITE EVALUATION

I. INTRODUCTION

1.01 Dredged sediments have been routinely disposed of in the oceans for the past one hundred years or more. Open water disposal sites in LIS are depicted on maps dating back to 1889. These sites were primarily small 250 acre areas and were located immediately offshore from the specific harbor/port they serviced (i.e. Stamford, Norfolk, Bridgeport, New Haven). In addition to disposal of dredged material, some of these dump sites received a variety of waste products, including building demolition debris and chemicals. Since WWII the volume of dredged material has increased as a result of port improvement and demands for recreational boat facilities. On a regional level, disposal of dredged material from proposed port improvements (i.e. Bridgeport, New Haven, Fall River, Boston) or large maintenance operations may have significant impacts. Compared with other material that are disposed of in the ocean, most of the dredged material excavated in New England is relatively innocuous. However, dredged material taken from urban and industrial port areas is usually contaminated with harmful chemical constituents such as heavy metals, synthetic organics, and oil and grease. Open water disposal of these materials carries the potential threat of acute or chronic toxic effects on marine organisms and potential contamination of human food resources. Extensive natural and commercial oyster beds exist in the immediate vicinity of numerous harbors bordering LIS. Seasonal restrictions on dredging/disposal are generally imposed to protect peak periods of oyster spawning activity as well as other shellfish species.

1.02 The loss and alteration of critical habitat is the most important concerns associated with the construction and operation of coastal engineering structures and facilities. The significance of habitat loss should be determined and evaluated in terms of effects on shellfish and fishery stocks and costs and benefits of restoration.

1.03 Since the inception of the National Environmental Policy Act in 1969, dredged material disposal has been recognized as a potential pollution threat in coastal and estuarine environments. The Dredged Material Research Program (DMRP), conducted by the Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi, explored the physical and chemical impacts of dredged material disposal, and a variety of disposal alternatives, including beneficial uses of dredged material. The program was well planned, and DMRP results are thoroughly documented by technical reports on specific issues, synthesis reports, and summaries. This program was completed in March 1978 and at the planning and policy level, two major conclusions can be drawn from the results of DMRP (COE, 1978):

1) No single disposal alternative is preferable in all cases. Each dredging project is unique, and disposal options should be considered on a case-by-case basis.

2) An effective solution to the problem of dredged material disposal can be derived only from long-range regional planning and management of disposal activities.

1.04 Whether the continual long-term use of open water disposal sites in Long Island Sound will cause irreversible alterations in marine ecology is a question still to be answered and a topic of considerable public controversy. It is obvious, nevertheless, that large scale dumping would subject an area to recurring impacts; probably reducing the abundance or diversity of marine life. The concept of regional disposal, although necessitating a lasting commitment of an area, is widely accepted as a desirable way of minimizing overall area impacts, at least until further knowledge is accumulated on the direct and indirect effects of open water disposal of dredged material. Site specific monitoring studies conducted over the last decade have provided valuable information on gross physical and biological impacts. Continued studies are needed, however, on the rates and mechanisms of pollutant releases, chemical forms that can be readily taken up by organisms, long term fates and acute and chronic effects.

1.05 It has become apparent that planning and environmental evaluation of dredging projects on a case by case basis, although essential, must be supplemented by a broader Long Island Sound-wide assessment of project interrelationships, disposal requirements, sediment quality, regional disposal sites, alternative disposal methods and productive uses of dredged material and monitoring of disposal sites and dumping activities. Only by this approach can impacts on long term productivity be identified and their signficance determined.

1.06 Proposals for disposal of dredged material in freshwater and in coastal areas to the outer boundary of the territorial sea are regulated under the Federal Water Pollution Control Act (FWPCA). The jurisdiction of the Marine Protection, Research, and Sanctuaries Act (MPRSA) extends outward from the baseline from which the territorial sea is measured. Therefore, a zone of jurisdictional overlap exists between the baseline and the outer boundary of the territorial sea where, strictly speaking, the provisions of both the FWPCA and the MPRSA would apply. To eliminate this problem, EPA and the Corps have reached an agreement stipulating that only the (MPRSA) Marine Protection Research and Sanctuaries Act will be applied in the zone of overlap. Therefore, the vast majority of ocean-disposed dredged material must be evaluated under the MPRSA and pursuant regulations. The guidelines contained in the MPRSA take into account the international provisions of the London Ocean Dumping Convention. The intent of MRPSA, as it pertains to dredged material disposal, is to limit adverse ecological effects of ocean dumping.

1.07 Open water disposal of dredged material has been the chief method in the past. However, it has certain environmental drawbacks. As discussed previously the New England Division has, in consequence, directed to investigate the feasibility of shallow water disposal in diked containments. The potential benefits of such disposal include creation of marshes, islands, storm protection structures, and the creation of land for commercial/industrial development. The potential benefits, as well as the desirability of minimizing open water disposal, led the New England River Basins Commission to recommend that the Corps undertake such a feasibility study. The LIS Dredged Material Containment Study will hopefully facilitate the development of long term disposal strategies. Over three hundred potential upland and shallow water disposal sites have been identified and evaluated, future volumes and quality of dredged material estimated, and alternative disposal methods assessed.

II. AUTHORITY FOR STUDY

2.01 The Long Island Sound Dredged Material Containment Study was authorized by Congress in May 1977. The authority to conduct this study is outlined in a resolution of the Committee on Public Works and Transportation, U.S. House of Representatives sponsored jointly by three Connecticut congressmen and adopted 10 May 1977. The resolution reads as follows:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbor is hereby requested to review the reports on the Land and Water Resources of the New England-New York Region, published as Senate Document Numbered 14, Eighty-Fifth Congress, First Session, and other pertinent reports, with a view to determining the feasibility and impacts of the treatment and use of the dredged materials to result from the continued maintenance and anticipated improvements of Long Island Sound harbors, as well as from any newly created Federal harbors, to build artificial islands in Long Island Sound for recreation, conservation, marsh building, development, and other purposes. The study should also consider the utilization of dredged materials from projects other than Federal (i.e., State, community and private), and the feasibility and acceptability of utilizing solid wastes other than dredged materials for island building."

2.02 The preliminary phase of the study process was completed when the Reconnaissance Report was issued in January 1979. At that time only Connecticut was included in the study area. Upon approval of the Reconnaissance Report by the Chief of Engineers in Washington, D.C., it was recommended that the New York portion of Long Island Sound be included as its waters could be affected by work done in Connecticut.

2.03 An Interim Report, completed in July 1980, presents dredging projects and an inventory of past dredging activities for the New York area. This report also included a preliminary siting analysis of potential publicly-owned sites in Connecticut and New York. The Addendum to the Interim Report completed in March 1981, extended the siting analysis to include shallow water areas, municipal wastewater treatment plants, power generating stations, Corps jetties and breakwaters, industrial waste dischargers, petroleum facilities and sand and gravel pits. Over 200 shoreline and near shore areas in Connecticut and New York were evaluated and rated.

2.04 Two sites, Clinton Harbor and Black Ledge (Groton), Connecticut, were selected as "prototype" study areas for dredged material containment facilities. Both sites were recommended to the Corps by local interest groups and have the support of local officials. A detailed analysis was conducted during 1981-1982 to better enable us to estimate the costs and determine possible impacts.

III. ALTERNATIVES

3.01 Historically, dredged material has been disposed of by the most convenient and generally the least expensive method available. This has translated into dumping on the nearest available open space on land, or more often, in water. The growing concern about contaminants in these wastes has reduced the acceptability of previous methods. Concurrently, economics has reduced the acceptability of transporting dredged materials long distances for offshore open water disposal. The need for dredging and resultant production of huge volumes of materials have led to the need for examination of alternative methods of disposal which minimize damage to the environment and in some instances, prove to be environmental and/or economic assets.

3.02 Dredged material can be used for creation of or improvements to wildlife habitat. These sediments can also be used to create upland habitats for mammals, or nesting and feeding areas for waterfowl. In specialized applications, periodic deposition of new material can prevent excessive vegetation and preserve a habitat for species dependent on bare sand for nesting purposes. Where transport is economically feasible, dredge materials can be used to fill abandoned pits and quarries, or reclaim strip mined lands and enhance agricultural lands. In areas where grain size is compatible, sediments can be utilized for beach nourishment.

3.03 Along waterfront areas, dredged material can expand or supplement existing facilities. Possibilities include such diverse choices as port development, industrial/commercial development, open space, recreation areas, and marinas. Proper design of the containment structure to allow access to the intended facility, and requisite drainage to allow settling and compaction of sediments, makes dredged material a candidate for multiple applications in waterfront development. Similar methods can and have been used to create offshore artificial islands for special facility siting.

3.04 <u>Alternative Disposal Sites.</u>

3.05 <u>Site Selection and Screening Process.</u> An important component of the Long Island Sound containment program is the selection of one or more sites where feasibility studies can be carried out. This does not necessarily mean that any selected locations will actually be used as dredged material containment sites. What it does mean is that there must be a transfer from hypothetical to real locations to develop a basis for accurate feasibility assessment. The analysis must be derived from real data at actual locations. Only in this way can there be a dependable answer to whether dredged material containment is a possible solution to the problem of disposing contaminated sediments in Long Island Sound.

3.06 Selection of sites is a major component of the planning process. In the course of planning, a series of limiting criteria will be applied for each site possibility. These criteria are: (a) bathymetry

(bottom topography) and the resulting potential containment volume; (b) shoreline ownership and location of existing disposal areas; (c) proximity to special ecological areas, wetlands, or major beaches; (d) wave energy - potential containment wall erosion; and (e) land use compatibility and reuse potential.

3.07 Once a series of possible sites are identified, further evaluation will proceed using these additional criteria: (1) engineering feasibility; (b) economic value; (c) environmental considerations; (d) social acceptance; and (e) legal or regulatory requirements. A weighting system is used to develop a matrix for evaluation. Criteria points representing physical and geographic characteristics are also awarded for each site's suitability compared to an optional site.

3.08 Data for general, large scale investigations are usually developed from existing information sources, i.e., charts, maps, previous studies, and surveys. As sites become more specific, the investigations become more refined and greater effort is expended on considerations specifically appropriate for each site alternative.

3.09 Alternative Prototype Disposal Study Sites. In addition to the Clinton Harbor and Black Ledge prototype studies, various other sites have been identified or recommended by local and study interest as possible alternative containment sites. These sites are located as follows:

(1) Flushing Bay, NY

(2) Mamaroneck, NY (1 upland site and 3 sites adjacent to rocky shoal)

(3) Sherwood Island (actually an offshore borrow hole (s))

(4) Yellow Mill Channel, Bridgeport

(5) Penfield Shoals

(6) Milford Harbor (outside of entrance jettys, west side)

(7) Thames River, New London under Gold Star Bridge

(8) Menunketesuch Island, off Patchogue River

(9) Guilford Harbor (actual upland site)

(10) West Haven (actually an upland site)

(11) Mouth of Housatonic (off Milford behind breakwater)

3.10 The Fish and Wildlife Service, at the request of the New England Division Army Corps of Engineers, has conducted a preliminary

environmental evaluation of sensitivity ranking of these sites. The environmental ratings were determined from the U.S. Fish and Wildlife Service's Habitat Evaluation Procedure (HEP), employing the calculations of Relative Value Indices (RVI). The RVI criteria used included: (1) fishery resources; (2) wildlife resources; (3) water quality; (4) physical characteristics; and, (5) development potential. The description of the aforementioned sites and results of the evaluation and habitat ranking system is contained in Appendix A.

3.11 Certain characteristics must be considered in determining the suitability of a potential site for dredged material disposal. A potentially viable containment site would be located along the shoreline or in water of 20 feet or less in depth and close to dredging activities. A preferred site would be an area inhabited by a minimal amount of finfish, shellfish and other marine life with dimensions of at least 400 feet by 600 feet and/or has a capacity of at least 200,000 c.y. Other factors which would be considered in evaluating a site are ease of construction and accessibility for the dredging disposal operations. These will be dependent upon the location and the characteristics of the adjacent areas. The proposed use of the filled facility should be compatible with existing land use in adjacent areas and also with local planning and zoning. It appears that the most publicly acceptable sites are usually areas that would involve creating or recreating a saltmarsh or restoring an area to its former state where severe erosion has occurred. Areas that are presently saltwater marshes or public use areas are generally not acceptable as potential candidates for DMCF's.

3.12 Probable Impacts At Diked Disposal Sites. Certain effects of diked disposal are unavoidable, e.g., turbidity, odor, standing water and unconsolidated material. However, these effects will be of variable impact depending on their conflict with other uses of the area. For example, odor is a major impact in an urban area, a minor impact in an uninhabited area. Those impacts which cannot be avoided include:

- turbidity. This may be minimized by rapid mixing dilution for surrounding waters.

- odor. The secondary impact of odor is minimized in less populated areas. A variety of mitigation methods are available to reduce odors and are discussed in detail in para. 5.10 -5.13 (pp 47-48).

- safety and health hazards. These impacts can be minimized by strict control of access to the site or geographic isolation of the site.

- aesthetic and visual. These impacts can be minimized by geographic isolation, or screenings and plantings of less isolated site.

- removal of area from public access. The area filled is transformed into lands which may not be used for some years. This impact many be offset by the positive gain of useful land some years later.

3.13 The labor, materials and fuel committed for the dredging, dike construction and disposal are not retrievable and may be considered as commitments of resources for present and future generations.

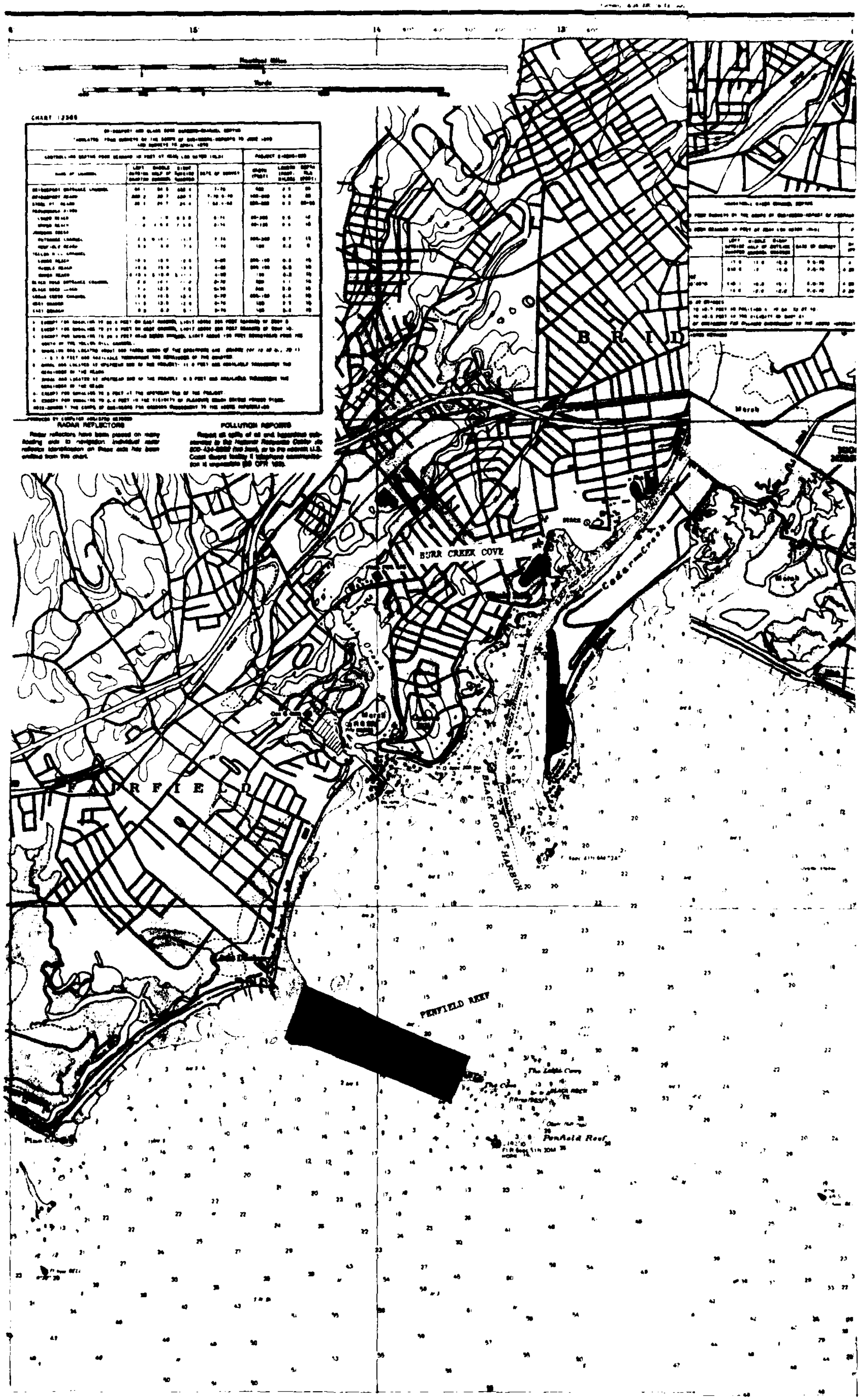
3.14 Benthic organisms will be eliminated from the dredging area through sediment disruption and removal and from the disposal area through smothering. Temporary reversible disruptions to the aquatic ecosystem would occur during dredging operations, mainly from increases in turbidity and the release of contaminants from the sediments.

3.15 Disposal of the polluted materials into the proposed disposal site is considered an irreversible and irretrievable use. The disposal sediments are not in short supply and represent no major natural resources in their present form.

Detailed information has been collected for some of the sites as follows:

3.16 Yellow Mill Channel is a man-made dredged channel located in the upper confines of Bridgeport Harbor (Figure 3-1). Local interests had expressed a desire in deauthorizing the channel and are receptive to filling it and development of a "green" area - recreational park for neighboring low income housing. An area approximately 2,400 feet x 400 feet extended from the I-95 overpass to Crescent Avenue at its head could be diked and filled. The dike would be constructed of impervious material hauled by truck from inland burrow pits. The structure would be 25 feet high which will rise 20 feet above mean low water. Construction of the dike would require 16,000 cubic yards of suitable material. It would be faced with one-foot of riprap on both sides and the top may be capped with a hard-surface path suitable for cycling or jogging. Construction of the dike could be completed within a three month period. For safety purposes, a chainlink fence would be erected around the construction site. When dewatering is completed, the surface of the construction facility will be capped with clean sand and a layer of topsoil suitable for the surface for a recreation area. The total elevation would be essentially that of the present banks of the channel.

3.17 The unit cost of disposal at the Yellow Mill Channel containment facility is $3.45/cu yd. This is considerably less than the unit cost for disposal at a site within 10 miles in Long Island Sound and only a little more than half the cost of open ocean disposal. It must be kept in mind, however, that with the availability of dredged material close to the containment facility, allowing hydraulic dredging and short distance pipeline transportation of material, the controlling element of the cost analysis is the construction of the containment facility in Yellow Mill



Nautical Miles
Yards
RADAR REFLECTORS
POLLUTION REPORTS
B R I D
BURR CREEK COVE
Cedar Creek
F A I R F I E L D
BLACK ROCK HARBOR
PENFIELD REEF
Penfield Reef
Marsh

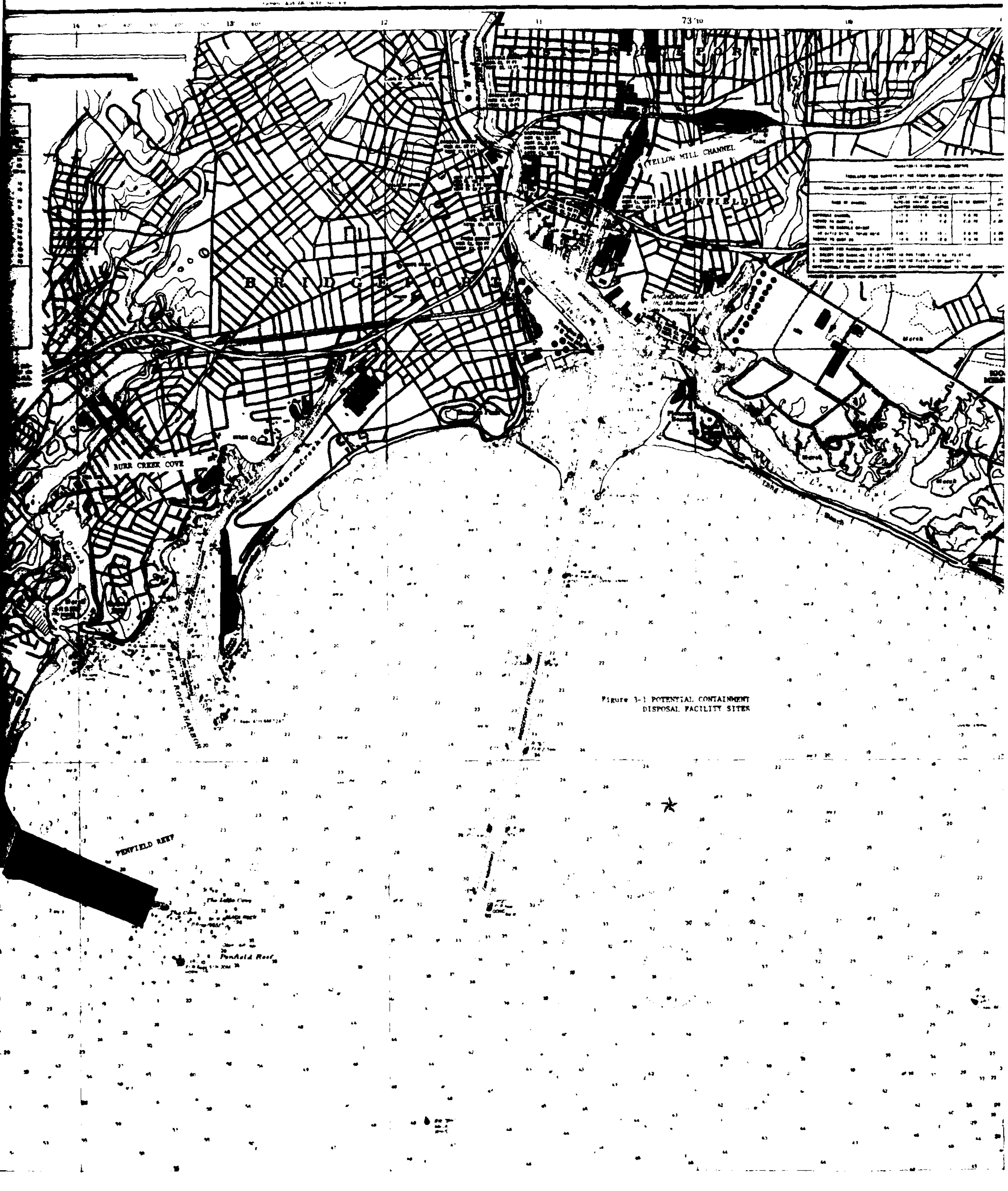


Figure 3-1 POTENTIAL CONTAINMENT DISPOSAL FACILITY SITES

Channel. Cost of construction of the earthen dike and filling the facility accounts for 28 percent of the total cost under the assumptions cited. The assumed cost of rerouting the storm drains is 29 percent of the total containment facility cost. Therefore, if the costs of storm drain rerouting are much higher (or lower) than assumed, the unit cost of $3.45/cu yd would change appreciably. If the period of disposal was assumed to be two years rather than five years, the unit cost would decrease to $3.15/cu yd.

3.18 For comparison purposes the overall costs of a steel bulkhead and hydraulically pumping about 830,000 cubic yards of dredged material into the site, as well as covering it with gravel and loam, is estimated at $5,358,000. The unit cost amounted to $7.14 per cubic yard compared to $5.34 per cubic yard for dumping the dredged material at sea. Other considerations not included in the estimate was the cost of purchasing riparian rights and the cost of surface drainage as previously mentioned. A gravel dike with a rock revetment and including dredging and post-dredge covering and seeding would cost considerably less at $2,961,000.

3.19 Environmentally, Yellow Mill Channel is a severely stressed water body. Results of the benthic sampling surveys in April and August 1981[10] revealed that sediments consist of black highly organic and methanogenic muds. The April survey showed the area to be dominated by a single species of Capetellid worm. In August the entire channel was azoic and no animal life found. The habitat index value assigned in April ranged for a 1 to +3 and in August a -8. In terms of water quality the channel is characterized by high fecal and total coliform counts. Results of bulk chemical analyses from two cores taken in 1973 showed high values for heavy metals including 4.4 and 5.4 ppm for Mercury, 32 and 39 ppm for Cadmium and 1.05 ppm for PCB's. A single sediment core obtained in 1980 revealed extremely high surficial concentrations of mercury, lead, zinc, and copper to be 11.6 ppm, 1,046 ppm, 109,998 ppm, and 42,333 ppm, respectively.

3.20 The channel has also been the recipient of PCB contamination for at least the past 20 years. Universal Manufacturers, Inc., has been identified as the primary source of the PCB pollution which resulted from the manufacture of capacitors during the period from 1956 through 1976. Delivery of the PCB's was by rail and accidental spills and subsequent runoff during offloading entered the system through the storm drain located at the head of the channel. In 1976 the EPA Lexington, Massachusetts laboratory collected a single sediment sample from the upper reaches of the channel which exhibited PCB levels of 280 ppm (per communication, Mr. Ray Thompson, EPA, 9 June 1982).

3.21 Yellow Mill Channel, therefore, could be acting as a potential source of further contamination of PCB's as well as heavy metals to Bridgeport's main harbor entrance and open water immediately adjacent. The Fish and Wildlife Service have placed this site in its least sensitive group and assigned it a new habitat value of .28 which enhances it's significance as a potential containment disposal area.

3.22 In a letter to the Corps dated 9 Sept. 1982 however, the Mayor of Bridgeport has indicated that "The estimated $3,566,000 minimum cost to the city plus the cost of purchasing riparian rights from abutting property owners; cost of surface runoff drainage, and other environmental cost to construct a containment area at Yellow Mill and Burr Creek Cove cannot be borne by the city at this time. The approximately 26 acres of land created at these sites would be restricted to recreational parkland uses by the materials used and this could not be marketed for any activities that would provide the city with a return on its investment."

3.23 Penfield Bar and Reef. The town of Fairfield Conservation Commission has forwarded, in conjunction with the Long Island Sound Dredge Material Containment Study, a proposal (letter, 22 March 1982)[17] to create a dredged material disposal island at the Penfield Reef area (Figure 3-2). Historically, the Penfield Reef or shoal was an island varying from 50 to 200 acres depending on the tide. It developed a reasonable soil profile supporting beach grass, bayberry and scrub oak, allowing pasturage by cattle and sheep. Pasturing and removal of protecting riprap for ballast stone initiated erosion of the island which washed away in the late 19th century.

3.24 The site is within 1.5 miles of the Bridgeport and Black Rock Harbor channels and within 4 to 6 miles of the Southport and Housatonic River channels, respectively. The dredged spoil island would be approximately 70 acres in area, rising from -4 feet to +10 feet MSL, providing for an interior contained volume of about 1.6 million cubic yards of "contaminated" dredge spoil and surrounded by "clean" spoil, sweeping westerly on the old tombolo as a "sacrificial island" sand reservoir for littoral drift moving across the coastal beaches. The outer island would be a permanent improvement, protected by stone riprap and offering enhanced wildlife and recreational opportunities after reaching its design capacity. The connecting island would be of fluctuating size depending on current scour and periodic dredge spoil replenishment. A causeway could be built out from shore along the existing sand bar if needed or desired.

3.25 Today the area contains the spine of the old island as a distinct hazard to navigation. The area is closed to shellfishing, is adjacent to Fairfield's sanitary sewer outfall, and is in close proximity to both Black Rock and Bridgeport Harbors and the Penfield Reef cable area. The area has public access from the shore yet is isolated at all times. Shallow waters lie to the west while deep water to the east would permit off-loading of dredge spoil from barges. Water depths in the area and existing bottom topography would appear to favor an increase in expansion of the facility well beyond the initial 70 acres, thus providing long-term (20 years) disposal usage. The project, with proper diking in place, would afford protection to the Fairfield Beach and Black Rock Harbor areas and associated recreational boating. The site is located near seed oyster grounds and an undetermined amount of bottom habitat may be lost if a containment facility construction was undertaken.

Conversely, it could also provide protection to the beds and allow a greater productivity than presently realized.

3.26 According to the Fairfield Conservation Commission benefits associated with this proposal to reestablish Penfield Peninsula would include:

- Increased storm and hurricane wave protection to the hundreds of homes on the shoreline.

- Increased protection for any direct beach nourishment program.

- Provisions for continually resupplying sand to the naturally eroding beaches through programmed depletion and resupply of sacrificial sand around the Peninsula.

- Restore protection to Black Rock Harbor from south and southwest waves by reducing their fetch from 20 miles to 1 mile.

- A tendency to reduce the normal drift of available sand dune to a lower wave energy regime in the lee of the Peninsula

- Provisions for enhanced public and private property values in Fairfield and Bridgeport.

- Public recognition and commitment to correct a serious beach erosion problem which will result in loss of dense residential development. Such commitment could include establishing a shore management board, guiding the public and private use, restoration and management of the barrier beach, peninsula, shore, dunes and tidal wetlands in Fairfield.

- Utilization of an existing hazard to navigation thereby reducing its threat to commercial and recreational boating. By recreating the peninsula above the existing reef, local mariners will be less inclined to "jump the bar" and go aground as a result.

- Provision for long-term, cost effective maintenance and expansion of harbors, channels and marine-oriented facilities in the Greater Bridgeport Region.

- Provision for recycling dredge spoil currently viewed as waste product by most people today.

- Provision for creating new wildlife habitat.

- Expansion of existing public park and marine areas. Since the Peninsula would be developed from the sea floor as an extension of Fairfield, it is anticipated it would remain as a public resource.

- Expansion of public recreational beach area for fishing and swimming with maintenance responsibility contingent upon the uses approved by the town.

- Possibility of increasing shellfish production by decreasing the opportunity for sewage effluent/suspended sediment from reaching the beds during the critical summer spawning period. Because of this effect, local oyster companies have indicated preliminary support for this proposal.

- Increased protection of the sanitary sewer outfall, thereby reducing the likelihood of pipe failure in the near shore area.

3.27 Potential vegetation impact of recreating Penfield Peninsula could include:

- Possible objection of beach-front property owners in close proximity to the base of the Peninsula during the construction period.

- Outright loss of habitat for fish, shellfish, lobsters, etc., due to the physical covering of the reef by the "footprint" of the Peninsula. However, new sediments deposited in the area could actually increase fish and bottom-dwelling organisms by introducing more diversity in habitat.

3.28 During the summer of 1982 the New England Division's Impact Analysis Branch contracted to complete a baseline ecological study of the site. The objective of the Penfield Reef Study was to delineate the extent of the reef and document the substrate and fauna through diver observations and grab samples.

3.29 Six "SCUBA" ecology transect surveys were conducted and 16 grab samples were obtained on August 30-31 and September 1-2, (Figure 3-2). The dive transects were plotted, beginning at the top of the reef and extending one-half mile outward. A Motorola Mini-Ranger Transponder system was utilized to ascertain station positions. Information was recorded on bottom type, algae cover, occurrence of commercial species at 0.1mm intervals of the transects. Underwater photographs were taken at selected locations on each transect. A total of 122 species of benthic invertebrates and 23 species of algae were identified from the hard-substrate samples and 125 taxa from the grabs.

3.30 The data indicate a unique assemblage of taxa on the reef dominated by three amphipods, Caprella penantis, Jassa falcata and Corophium spp. Two of these taxa; Corophium spp. can be observed in both hard and soft substrate communities. A .hough the samples are dominated by these three taxa, there is a high diversity of other species, most of

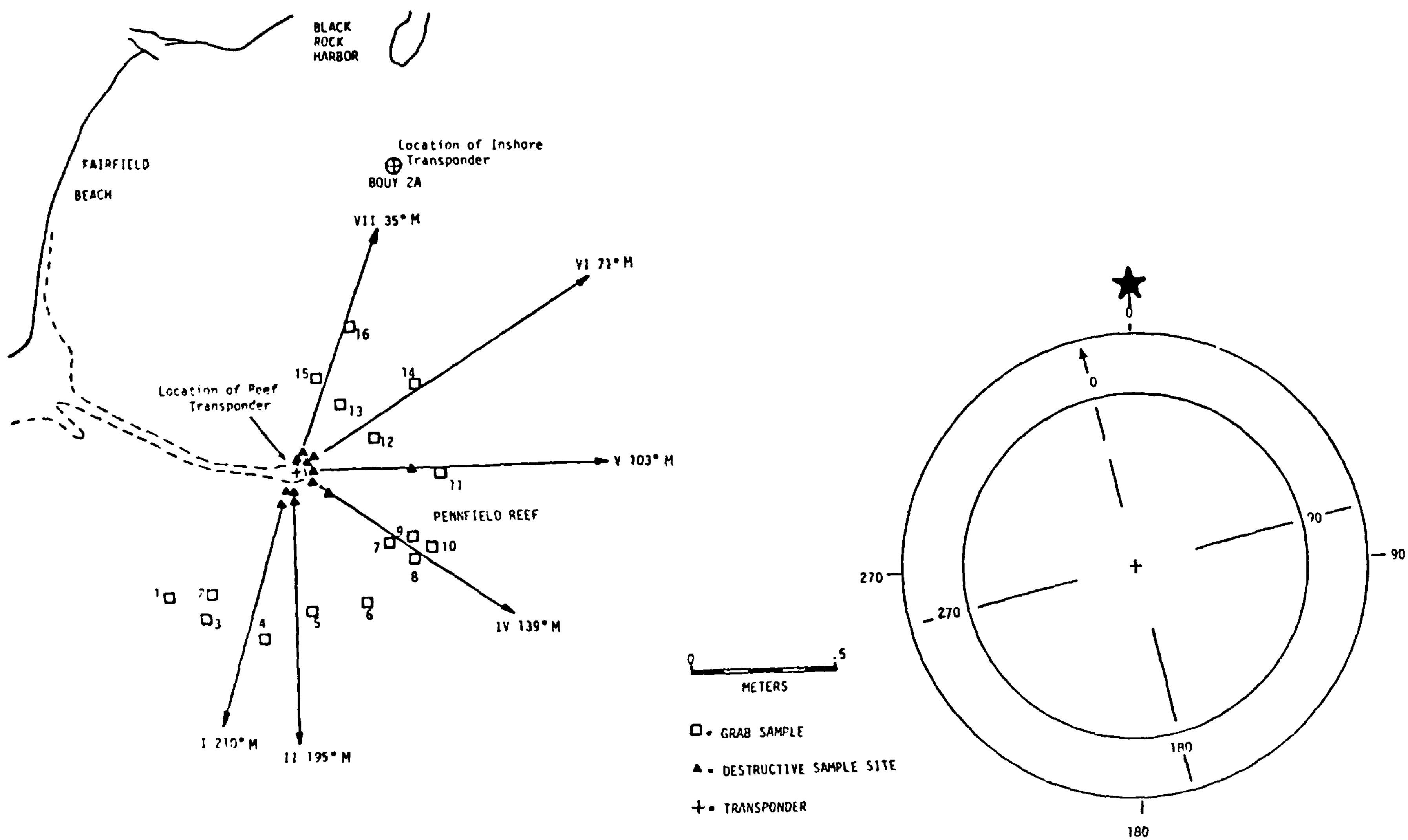


Figure 3-2 Transects and grab station at Pennfield Reef.

which are associated with hard substrates. There are a number of taxa associated with soft substrate, probably as a result of the matrix of sediment surrounding the rocks, boulders and cobbles which provides a diversity of habitat types and ecological niches.

3.31 The grabs taken at Penfield Reef show a mixture of taxa; some stations resemble the reef stations (hard-substrate) while others are dominated by typical soft-substrate dominants like oligochaetes, Streblospio benedicti and Mediomastus sp. These grabs may provide an indication of soft/hard-substrate community delineation in some areas.

3.32 The area around Penfield Reef is extremely productive and supports a diverse fauna. Faunal densities for the Penfield samples were generally higher than other north temperate hard substrate communities encountered. This data however, provides no temporal information so densities at other periods are unknown. One of the major dominant amphipods, Jassa falcata, is known to have multiple generations and other amphipods are suspected to have similar recruitment patterns; thus, densities may remain high throughout most of the year.

3.33 Diver observations indicate the presence of numerous epibenthic organisms and fish, further indicating the richness of the area.

3.34 The Fish and Wildlife Service has stated that "the reef area is considered to be one of the better surf fishing spots in the State of Connecticut and the shoal is used extensively by water fowl and provides excellent feeding and resting habitat for a variety of sea and shore-birds." Based on the information available they have listed Penfield Reef in the "most sensitive" group and assigned it the highest (1.00) habitat value of the sites they have evaluated. However, this does not mean that the construction of a containment facility cannot better the existing sedimentation condition of the area and provide some of the benefits outlined in para. 3.26. Placement of a DMCF along the sand bar leading out to the reef would minimize any effects to those animal and plant communities associated with the rocky substrate characterizing the eastern portion of the reef system.

3.35 Milford Harbor. The Milford survey was conducted to provide information on the faunal composition of the area adjacent and inshore of the Burns Point Jetty. Twelve grab samples were taken in the area adjacent to and seaward of the Jetty on August 25, 1982 (Figure 3-3). A total of 82 taxa were identified. The substrate at all stations, except 9, was hard-packed fine sand. At Station 9, there was a mixture of cobbles and sand. Stations 10, 11 and 12, designated as part of the work-scope, were intertidal at low tide.

3.36 Milford Harbor represents a more typical estuarine habitat. The fauna is primarily dominated by polychaetes. Streblospio benedicti dominates many of the samples while Scoloplos and Scolecolepides are also important. Stations 8 and 9 are the most diverse stations. This may

result from a more heterogeneous substrate, particularly at Station 9. Biomass is generally low, except at stations where Ilyanassa obsoletus, the mud snail, is important.

3.37 Sherwood Island Survey. One of several potential containment sites under investigation is a borrow pit off the coast near Sherwood Island State Park in Westport. According to an official of the Aquaculture Division of the Connecticut Department of Agriculture, material from this area was used in the construction of the Connecticut Turnpike. Other borrow pits which were used at that time are located in Morris Cove and Prospect Beach in New Haven Harbor and Laurel Beach in Milford. Tests indicate that very little if any marine life exists in these very deep pits due to the anaerobic conditions. It has been suggested that these areas could possibly be rehabilitated by filling them with dredged material and capped with clean, coarse sand. Portions of these borrow pits could then be returned to the State for shellfish leases while another portion could be turned into an island for a bird sanctuary. A bathymetry survey has been made of the site to collect data to determine the exact location, depth and volume of the Sherwood Island hole. The data is being evaluated and the volume capacity will then be determined. The Sherwood borrow hole site has been rated "moderately sensitive by the Fish and Wildlife Service based on its proximity to commercial and recreational shellfish resources. It is thought however that filling of the burrow hole and capping can be accomplished without any adverse impacts to adjacent shellfish populations.

3.38 Survey and Data Collections at Other Sites. Addditional biological sampling and underwater photographic documentation is contemplated for some of the other sites listed in para. 3.09. The potential impact of a proposed containment facility at Penfield Reef on wave refraction/diffraction pattern and subsequent changes in sediment erosion/deposit in patterns will also be investigated.

3.39 Other potential sites which have been identified from previous dredging project evaluations, included the possibility of depositing all the dredge material in a double wall steel sheet pile container at New Haven (p. 5-6 Final EIS Maintenance Dredging New Haven Harbor, June 1973). The location selected was about half-way between the mouth of Old Field Creek and Sandy Point Breakwater light in shallow water and in an area devoid of oyster grounds. These same general locations have resurfaced again in discussion with NMFS and the State Aquaculture Division (meetings, February '82) regarding containment disposal areas.

3.40 Confined disposal areas should serve two basic purposes: (a) provide the volume necessary to contain material to be dredged, and (b) provide sufficient retention time to meet appropriate effluent standards. Also, disposal areas should be managed to obtain maximum capacity to minimize the need for additional areas. Management is justified on both economic and environmental bases. Management plans are not limited to simply increasing capacity through increasing dike heights. Consideration

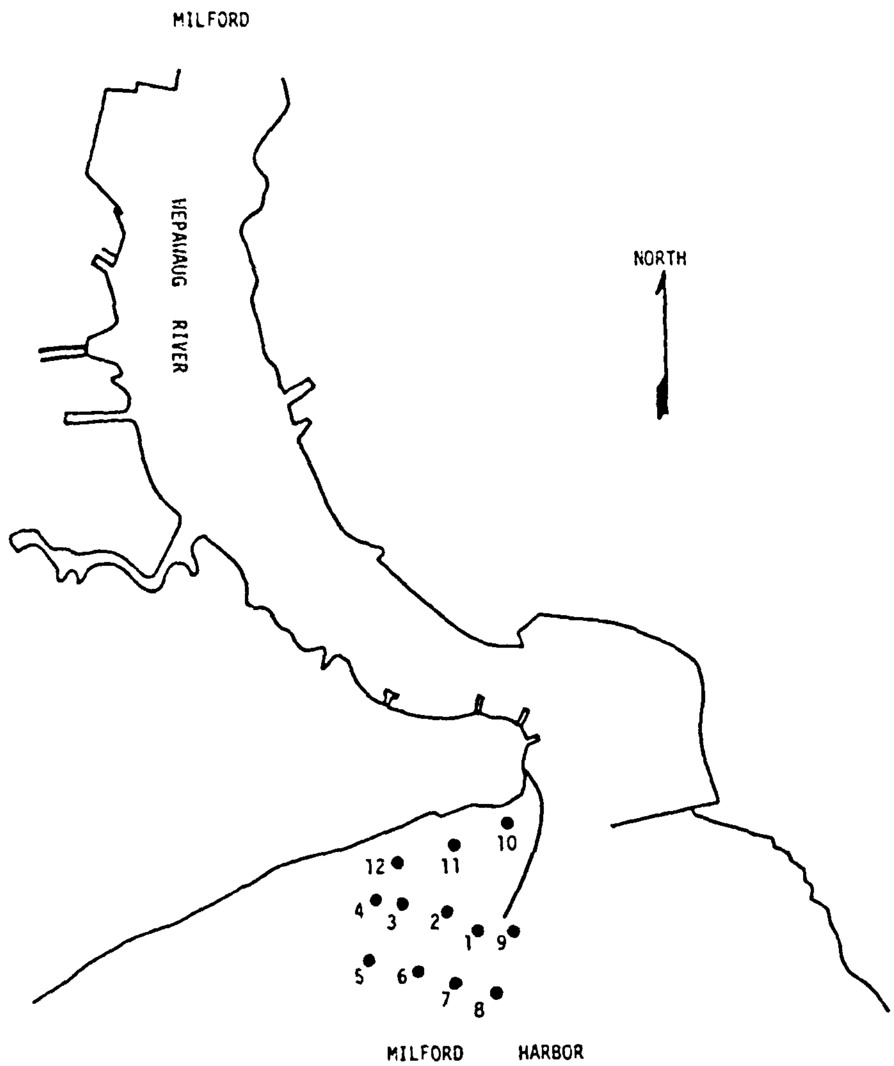


Figure 3-3 Map showing the stations in Milford Harbor

must also be given to increasing the capacity through such methods as dewatering and/or removal of material from the site for placement elsewhere.

3.41 Not all of the sites listed in paragraph 3.04 will undergo as detailed an analysis as Clinton Harbor, Yellow Mill Channel or Black Ledge. Some of these sites are expected to be screened out for environmental reasons or otherwise. Others such as Penfield Reef which appears to have generated considerable interest at the local level but with a preliminary high habitat value ranking assigned by the Fish and Wildlife Service will undoubtedly require further investigations to determine both its feasibility and public acceptability.

3.42 It is the intent of the New England Division Corps of Engineers to complete a prototype study of at least one site representive of the three types of containment structures (i.e., island, marsh creation and shallow water shoreline extensions) being considered. The data from these studies could then be extrapolated to most any other site within Long Island Sound thus enabling a more rapid assessment of the feasibility and impacts associated with the construction of such a facility.

3.43 Beach Nourishment

3.44 Another valid and constructive use of dredged sediments historically has been beach nourishment. Clean dredged sand is pumped to the beach hydraulically and left for reworking by tides, storms and currents. By conducting the project in late fall or winter, there is maximum likelihood that the beach profile will be restored by the following summer. The Long Island Sound Comprehensive Report recommended that 12 Connecticut beaches be artificially nourished to an average width of 300 feet where feasible.

3.45 To be practicable and effective, beach nourishment requires the use of nourishment material (fill) of appropriate physical composition and grain size. Coarse, sandy material which approximates the charcteristics of the native material is optimal. Mud, silt, clay, rock, sludge and other materials are inappropriate for beach nourishment. Beach nourishment can abate erosion problems and provide recreational and other benefits. Beach nourishment can be a cost-effective alternative or complement to structural shore protection. Unlike disposal of material in the deep ocean or diked areas, beach nourishment use of dredged material keeps the material in the littoral system (i.e., subject to wave-induced currents along the open ocean or Long Island Sound).

3.46 Constraints to Consideration of Beach Nourishment (Engineer Institute for Water Resources, 1981)

1. Other Use Preferred. Non-Federal sponsor prefers another use for dredged material.

2. Unsuitable Material. Grain size of material (e.g. silt, clay, mud, rock) is inappropriate for beach nourishment.

3. Environmental and Technical.

   a. Unacceptable water quality impacts expected;

   b. Unacceptable turbidity and fish and wildlife impacts expected;

   c. Shore physiography and use (shore character) is not suited for beach nourishment (i.e., beach nourishment would be inappropriate);

   d. A more suitable and/or less expensive source of beach nourishment material is available for use at beaches under consideration (and there is an alternative form of dredged material disposal which is of lesser cost and is environmentally acceptable);

   e. Ocean wave or current conditions are hazardous to the use of equipment for beach nourishment.

   f. Adverse effects on navigation and water uses are expected.

3.47 Constraints to Implementation of Beach Nourishment

4. Beach nourishment is undesirable from the standpoint of high incremental cost.

   a. Transport cost for dredged material is too high;

   b. Per unit mobilization, demobilization and/or pumping costs are too high;

   c. Dredging plant of least cost or equipped for beach nourishment is not available, and costs otherwise would have been acceptable.

5. There is no need for beach nourishment, although shore character is suited to nourishment.

6. Other institutional constraints (varying case by case) apply.

3.48 Beach disposal on sand dune restoration operations could cause high turbidity and increase the total solids in the nearshore water column over background level. Materials deposited above mean high water would cause less turbidity depending on the distance of the discharge pipe from the intertidal zone. In cases where the slurry drains initially on the beach above the high water line much of the solids would settle out before

reaching the water. The initial impact of such nourishment operations on benthic animals is to kill the benthos by physically covering them with the dredged sediments or drive the motile species away. The recruitment of beach animals will be delayed for as long as the operations persists. Monitoring of beach nourishment operations at Fort Macon Beach, North Carolina (Reilly and Bellis 1978, Reilly; Cobb and Bellis 1980) showed that the animals most affected by the nourishment were those that spend their entire life-cycle in the beach sands. The recruitment of the beach animals experienced a delay of two months as compared to the control beach. This delay was due to high turbidity and sedimentation. Replenishment operations during late fall and winter would reduce the effects of plantic larval recruitment and migratory species that return to the beach from offshore during the spring.

3.49 Open-water Disposal in LIS. There are 19 previously used disposal sites within the Long Island Sound area. In accordance with Region I EPA policy, no new disposal sites will be considered except under exceptional circumstances (i.e., emergency operations) and when and where practical to reduce the number of existing disposal sites. Based on this philosophy, the Long Island Sound sites have been reduced to four interim approved sites. They consist of New London, Cornfield Shoals off the Connecticut River, New Haven or the Central Long Island Sound site, and the recently selected Western Long Island Sound III site. Undesignated ocean dumpsites, those not either interim approved or formally designated will not be used.

3.50 Operational consideration and recommendations for an open-water Long Island Sound Dumping Grounds Monitoring program has been outlined by the State of Connecticut and New York and N.E. River Basin Commission in the LIS Interim Disposal Management Plan. For sites within the territorial baseline (3 miles offshore), Section 404 of the Federal Water Pollution Control Act of 1972, as amended, will apply. Disposal sites within Long Island Sound, such as the historic New Haven or Bridgeport dump grounds, would come under the jurisdiction of this act. EPA has the final approval over the selection or designation of any disposal sites.

3.51 New Haven or Central LIS Dumping Grounds. The New Haven Dumping Grounds are located in central Long Island Sound, centered at approximately 41^{o}-08'-45" north latitude and 72^{o}-53'-15" west longitude, about 6 nautical miles (NM) south of the entrance to New Haven Harbor, Connecticut.

3.52 The bottom substrate at the site is comprised of silts and clayey silts with less than 20 percent sand. Presumably the existing sediments have accumulated as a result of past disposal operations and are therefore not necessarily representative of natural sediments characterizing the central basin of the Sound. The bottom is relatively featureless and slopes gently to the south and is an environment of net sediment deposition. Existing water depths range from 15 to 23 meters. Maximum tidal currents at the bottom are moderate (27-31 cm/sec) and wave induced currents are low.

3.53 Between March 1974 and October 1979, 1.5 million cubic yards of material from New Haven and Guilford Harbors were dumped at this site. this material formed a symmetrical mound at the center of the disposal site; the minimum depth of water above the pile was 15 to 15.5 meters. After the New Haven project was completed additional material from private projects under Federal permit was dumped at a buoyed point southwest of the original site. There was no spoil disposal at this site from 1975 until 1977. From March 1979 to June 1980, 470,000 c.y. of spoils from Stamford and New Haven Harbors were dumped at two points 0.5 NM north and 19.5 meters of water a ove, respectively. Sand material excavated from the outer New Haven channel was used to cap Class III contaminated sediment from Stamford. In 1980-81 approximately 275,000 yds (pay yardage) of dredged material was excavated from the Federal project in Norwalk Harbor and dumped at a site approximately 0.5 NM west of the central mound.

3.54 The New Haven Dump Grounds is currently the only State approved aquatic disposal site in the Central Long Island Sound Region and has been the subject of extensive monitoring investigations. As such, this area has been judged to be suitable for Class I and Class II dredged material disposal and for Class III material disposal under certain conditions.

3.55 New London Disposal Site. The site is located south of the mouth of the Thames River at 41°16.3'N, 72°04.6'W. It is the historic disposal site for major dredging projects in the Thames River, most recently the channel enlargement by the U.S. Navy to the Electric Boat Co. for construction of the TRIDENT submarines.

3.56 There was extensive monitoring prior to and during a period of active spoil disposal (July 1974-July 1975). The final supplement to the Final Environmental Impact Statement, Naval Submarine Base, Groton, Connecticut, contains a thorough evaluation of potential and actual environmental impacts at one site. Only a brief summary is presented here.

3.57 Various physical and chemical parameters were monitored in the plume of the disposal barge during and after several dumps. Temperature, salinity, and density were not apprec'ably affected by dumping. Near-bottom light transmittance, an indication of turbidity, decreased by 50 to 100% immediately after dumping, but returned to ambient levels very rapidly (within a period of 10-60 minutes). Surface turbidity remained relatively constant. Near-bottom dissolved oxygen levels decreased (generally by about 30%) but also returned to ambient concentrations rapidly (within 10-40 minutes). Suspended and volatile solids increased but returned to ambient within 30 minutes to 2 hours.

3.58 Catches of bottom fish in the disposal area are now smaller than before sediment disposal. The most abundant species was winter flounder, followed by longhorn sculpin and winter skate.

3.59 Analysis of grab samples at the bottom of the disposal site indicated recognizable quantities of spoil material. Some recolonization of spoil material occurred. Overall, there was a decrease in faunal densitites, but this could not be differentiated from seasonal variation or other natural processes. Certain species (e.g., the nut clam, Nucula proxima) were apparently introduced into the disposal area with the dredged sediments. Other species present are characteristic of bottom community surrounding the disposal site.

3.60 In summary, the water quality impact of dredged material disposal at this site are local and temporary. Effects on sediments and bottom-dwelling organisms are confined to the immediate disposal area.

3.61 Cornfield Shoal. The historic Cornfield Shoal Dumping Ground is described as an area in Long Island Sound one nautical mile square (sides running true north-south and east-west) from the center of which Saybrook Breakwater Light bears N by E (magnetic) 4,900 yards, and Cornfield Point Lightship bears W 3/8 S (magnetic) 2,875 yards, or a true bearing 179° from Saybrook Breakwater Light. The depth of water ranges from 114 to 121 feet at M.L.W.

3.62 Current measurements taken at the Cornfield Shoal disposal site (Morton and Cook, 1975) indicate a strong semi-diurnal tidal influence. Current meters, approximately one meter above the bottom, were located in the northwest and southeast corners of the dumping ground. Average ebb currents were higher than average flood currents at both stations, with generally higher current velocities found at the southeast station. The highest velocity recorded was approximately 2.5 fps at the southeast station. Average current velocities at the southeast staton were 2.1 fps (ebb) and 1.8 fps (flood). At the northwest station, average ebb and flood velocities were 1.6 fps and 1.2 fps respectively.

3.63 Progressive vector plots of the current readings revealed a net northwesterly drift at the southeast station and a net westerly drift at the northwest meter. Mean velocity (ebb-flood) for the southeast station is 0.37 fps (319°) and 0.32 fps (285°) for the northwest station.

3.64 Based upon the above, and the fact that sediments at the Cornfield Shoal site are primarily composed of gravel and course sands (MACFC Informal Report No. 42, 1974), it appears that this is a dispersal site with Long Sand Shoal acting to modify the strength and direction of dispersal.

3.65 The general area in which the Cornfield Shoal site is located is assumed to be inhabited by nearly all of the approximately 100 finfish species known to inhabit Long Island Sound. Commercially important finfish in the area include shad, menhaden, alewife, scaup and flounder. The lobster yield and the intensity of fishing are not available.

3.66 Cornfield Shoal has been used previously as a disposal site for clean granular materials totalling slightly more than 1,008,000 cubic yards. During 1976-1977 the New England Division conducted maintenance dredging of 110,000 cubic yards from North Cove, 23,000 cubic yards from Breakway Bar and 20,000 cubic yards from Essex Shoal. Disposal of this material was accomplished by point dumping at a site approximately 1/2 mile southwest of the historic charted Cornfield Shoal disposal area.

3.67 Although point dumping was used at the site, dredged sediments deposited did not form a distinctive topographic feature on the bottom. Neither side scan sonar nor bathymetric surveys were able to detect any change in the bottom indicative of dredged material (DAMOS site Report, 1979). Sediment samples collected from the site however have exhibited extremely high concentrations and enrichment relative to iron indicating that some dredged sediments are present in isolated patches. It was determined that the residual current component at Cornfield Shoals is significantly greater than that at New London, thus most fine sediments are dispersed.

3.68 <u>WLIS III.</u> In December 1981 the Corps of Engineers NED in coordination with the State of Connecticut and New York proposed to designate a regional disposal site in Western Long Island Sound (WLIS-III).

3.69 The WLIS III disposal site (approximately W 73° 27.8'-29.5' Long.; N 40° 58.8'-41° 00' Lat.) is located within the triangle bordered by the Stamford disposal site on the west, the South Norwalk disposal site on the northeast and the Eaton's Neck disposal site on the east (Figure 2). It occupies an "east-west" oriented trench which ranges in depth from 115 feet in the valley to 80-90 feet along its upper sides. The general area is protected on the east by an extensive sandy ridge ranging from north of the Cable and Anchor Reef to Eaton's Neck on Long Island.

3.70 A description of the physical oceanography, water quality, sediments and impacts from use of this site are evaluated in detail in the final EIS issued February 1982.

IV. AFFECTED ENVIRONMENT

4.01 Clinton Harbor Confined Disposal of Dredged Material and Marsh Creation/Establishment

4.02 The present prototype study attempts to determine the environmental acceptability of the site. Baseline biological data have been collected which serve to characterize and evaluate the natural habitat(s) value and associated marine life. This baseline environmental information, combined with engineering structural designs and socio-economic studies, will be used to assess potential operational impacts and feasibility of construction of a containment facility at Black Ledge and marsh creation at Clinton Harbor. The following description of Sites and Conclusions has been taken from T..xon's March 1982 prototype site evaluation reports.

4.03 Clinton Harbor, Connecticut, is one of several locations in the Long Island Sound area being considered for construction of a dredged material semi-containment facility (DMCF).

4.04 The proposed disposal location, as shown in Figure 4-1, is located to the west of the Federal navigation channel and adjacent to existing beach and salt marsh lands near Hammonasset State Park. An opportunity exists to expand the Hammonasset marsh and create additional salt marsh valuable for wetland habitat. Two sizes of the DMCF are considered to account for possible variations in the amount of dredged material to be disposed. The smaller DMCF has an area of approximately 40 acres and the larger DMCF has an area of approximately 135 acres.

4.05 Because the objective of the Clinton Harbor DMCF is expansion and protection of the existing marsh area, only a low dike will be constructed, using quarry material (fine crushed sediment) or a relatively impermeable core faced with two feet of riprap for erosion protection. In its final form, the containment facility would consist of channels for tidal movement with vegetative areas in between, similar to the neighboring marsh. The Clinton DMCF is expected to be filled, using a hydraulic dredge and floating pipeline transport and disposal. Within two or three years after filling, the dike and dewatered areas within the DMCF would be covered with plantings established during marsh creation.

4.06 Improvement dredging of the Federal channel into Clinton, inner harbor, and of the private facilities in the harbor is forecasted to produce initially up to 300,000 cubic yards of dredged materials and subsequent annual quantities of about 35,000 cubic yards.

4.07 Site Suitability and Potential for Enhancement

4.08 The site is too exposed as evidenced by erosion of the existing marsh shoreline, to qualify for uncontained dredged material disposal with subsequent habitat development. However, if the site is protected by a

permanent breakwater constructed along its seaward perimeter, it becomes suitable for a combination of contained (for fines) and uncontained (for sands) disposal within. The breakwater could be constructed in totality or sequentially to the extent necessary to offer protection for these quantities of materials that are periodically dredged.

4.09 The site has a high potential for biological enhancement. Dredged material disposal and landscaping could be designed to offer a diversity of habitat types. For example:

a. Existing intertidal shores could be retained and under the protected environment acquire a layer of finer grained sediments that would provide an improved habitat for benthos.

b. New intertidal dredged material exterior areas could be developed to provide expanded areas of mudflat-marsh edge.

c. New dredged material interior areas could be developed to provide a combination of low and high elevation salt marsh and high elevation unvegetated areas to promote tern nesting.

d. Existing shallow water areas could be retained as a refuge and feeding area for fish.

4.10 The new habitat types would have potential educational value to the local community and to visitors to Hammonasset State Park. A recent boardwalk has been constructed through the salt marsh of the Hammonasset State Park to the sand berm at the south end of the site. This boardwalk provides public access to the site.

4.11 The present biological habitat value of the area proposed for the DMCF was judged to be relatively low due to chronic physical disturbance. Most of the resident communities in this area were in low order successional stages; this community type has the potential for high productivity if the frequency of disturbance is not too high. Secondary production estimates, based on standing stocks of dominant infaunal species, were found to be well below those documented in nearby strata with greater stability.

4.12 The creation of the proposed marsh area could potentially increase the biological habitat value of the harbor complex through increased habitat diversity and enhanced productivity. In addition to the beneficial effects of the marsh, the proposed stone containment structure would greatly increase the substratum available for hard-bottom communities in a manner analogous to that documented for artificial reefs. The construction of the DMCF as proposed therefore, can only enhance the biological value of the area as well as providing a highly acceptable solution to the problem of dredge sediment disposal; the disposal of waste sediments from dredging projects.

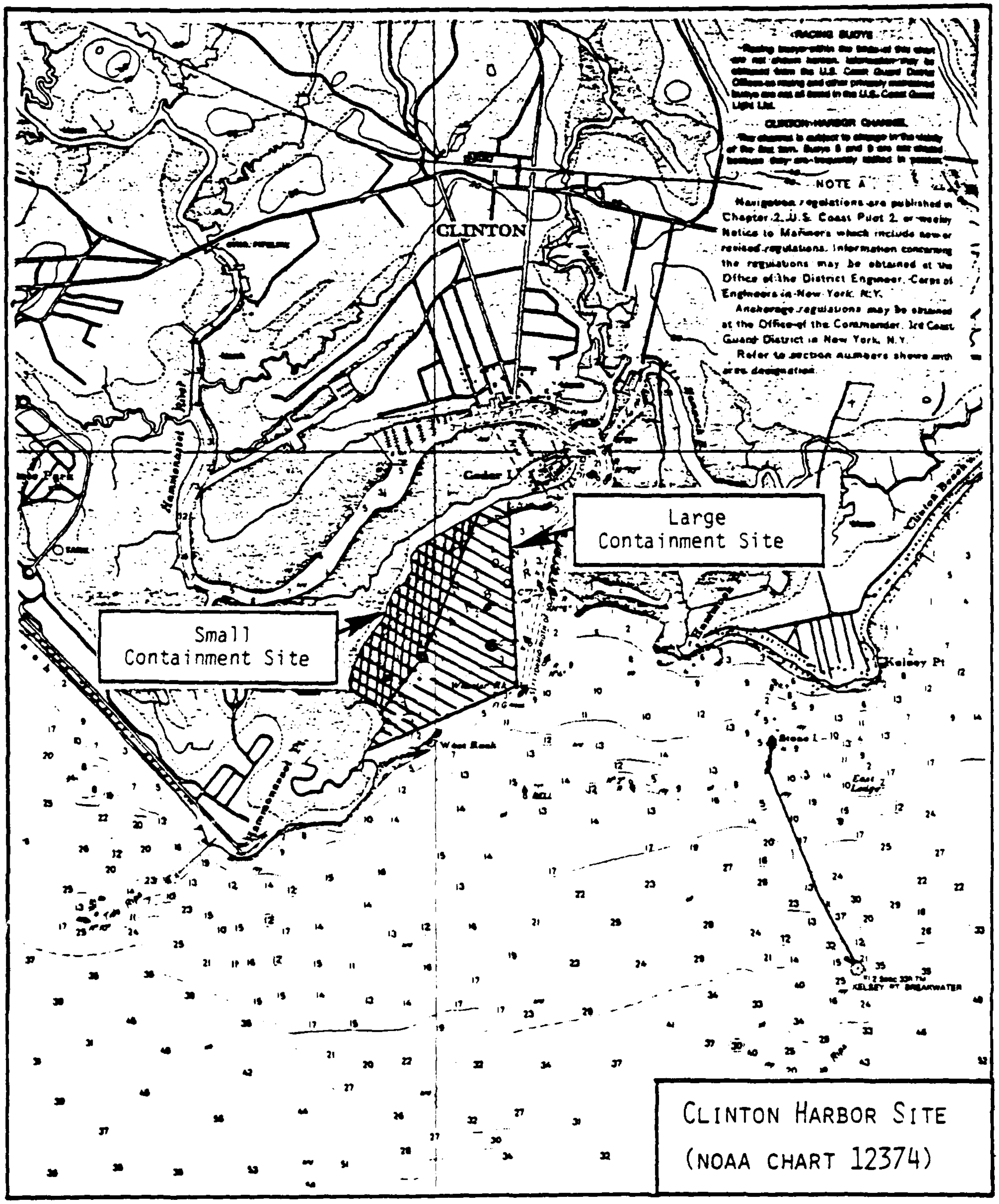


Figure 4-1 Proposed location of prototype dredged material containment facility.

4.13 Site Development and Conceptual Design

4.14 Recent (1980-1981) uncontained open water disposals of hydraulically dredged fine grained materials (mostly silts) by the Baltimore and Philadelphia District Corps of Engineers provided intertidal and supratidal slopes of 20-30 to 1. With this angle of repose, fine grained materials developed to mean high water at the site would flow at a radial distance of 1200 to 1800 feet from the pipe outfall. In order to prevent the infringement of dredged materials on the near shore and intertidal shore of the park, all fine grained dredged materials must be contained.

4.15 In development of a conceptual design for dredged material disposal and habitat development, the following items were assumed:

1. Mean Low Water = 0 ft; Mean High Water = 5.0 ft; Mean Tide Level = 2.5 ft; Spring Tide = 5.6 ft.

2. The average water depth throughout the site is -1 ft.

3. An adequate supply of sand to develop the containment structure for the fine grained dredged materials will be available from maintenance dredging of the Long Island Sound section of the Federal channel.

4. The particle size distribution of the sand is such that hydraulic dredging and open water disposal will provide an angle of repose of about 50 to 1 of the sand deposits.

5. The stone breakwater and the sand containment structure are developed to elevations of 7 ft.

6. The fine grained dredged materials are developed to elevations between 4.0 ft to 5.0 ft.

4.16 A sequential development of the site, concurrent with periodic dredged material disposal needs, is suggested. New wetland habitats c uld be developed throughout the sand containment structure and the fine grained materials as these areas are developed. Figure 4-2 shows the completely developed site. Assuming Items 1 through 6 above (General Conditions), Figure 4-2 reflects a developed site having the following characteristics:

1. Total capacity of about 1 MCY of dredged materials having:

   a) 375,000 cy yd of fine grained materials
   b) 625,000 cu yd of sand

2. 54 acres of _Spartina alterniflora_ salt marsh developed on fine grained materials at elevations between 4.0 ft and 5.0 ft.

3. 13 acres of Spartina alterniflora salt marsh developed throughout the sand containment structure at elevations between 2.5 ft and 5.0 ft.

4. 13 acres of Spartina patens salt marsh developed throughout the sand containment structure at elevations between 5.0 ft and 6.0 ft.

5. 15 acres of unvegetated intertidal sand flat at elevations between 0 ft and 2.5 ft.

6. 13 acres of unvegetated to sparsely vegetated sand nesting area at elevations between 6.0 ft and 7.0 ft.

7. 28 acres of shallow subtidal area at elevations between -1 ft and 0 ft.

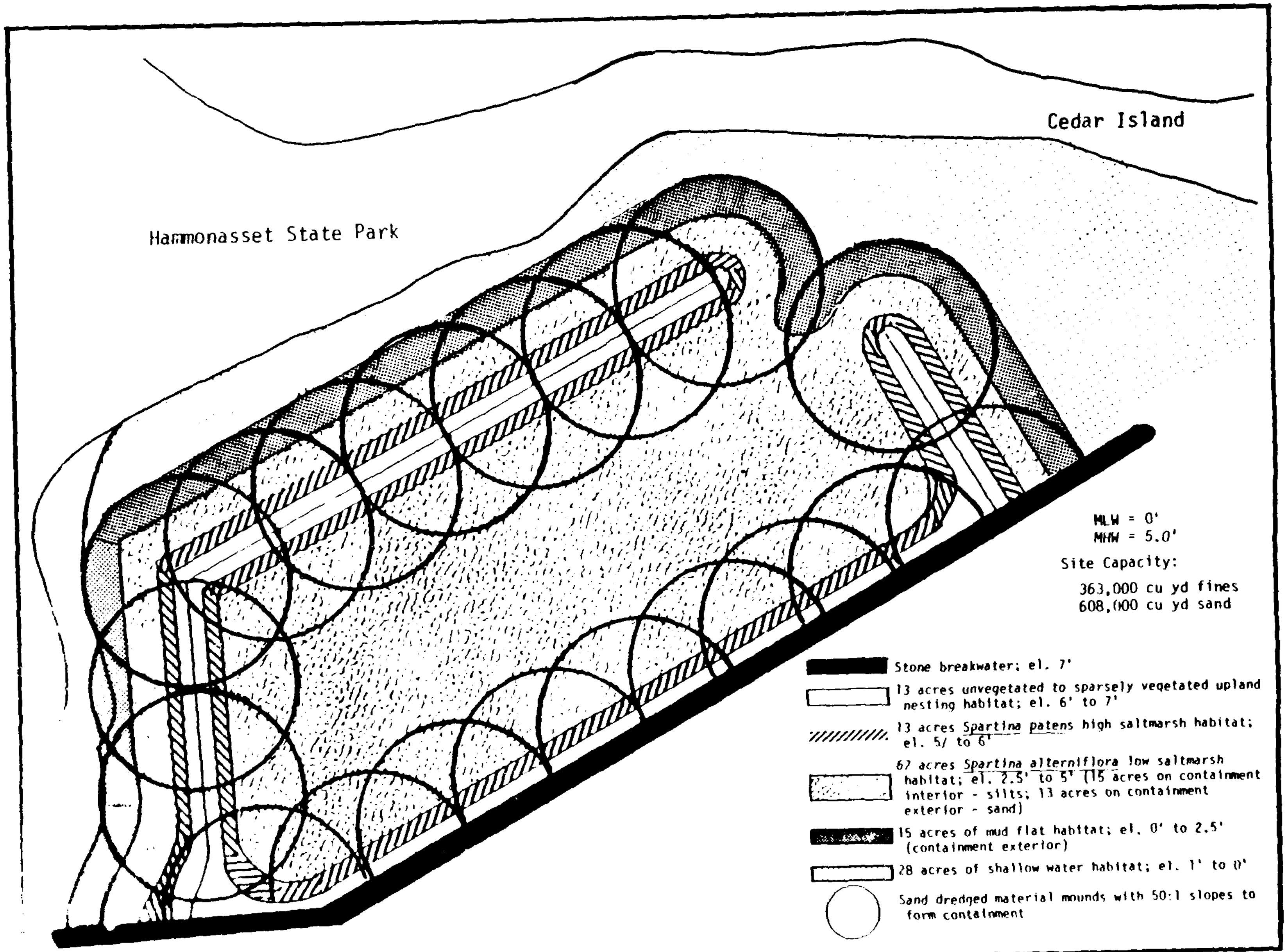
4.17 The site capacity for dredged sand and fine grained materials and the areas of the different types of habitats will vary as the angle of repose of the dredged sand varies from the assumed value of 50 to 1. Steeper sloping sands will reduce the site capacity for sand and increase it for fines. They would provide smaller areas of nesting, habitat, S. patens, S. alterniflora (on containment exterior), and mud flat and a larger area of the contained fine grained dredged materials and associated S. alterniflora. More gently sloping sands will reverse the above trends.

4.18 Any consideration of alternative designs should not include the development of fine grained materials above the mean high water elevation. Such a development would produce supersaline conditions and desiccation cracks throughout the sediments above mean high water and would limit the successful establishment of any vegetation throughout these sediments.

4.19 Veget ve Development

4.20 The establishment of S. alterniflora between elevations 4.0 ft to 5.0 ft can be accomplished by seeding. The establishment of this species between elevations 2.5 ft and 4.0 and of S. patens between elevations 5.0 and 6.0 ft must be accomplished by transplanting peat-potted nursery stock. Sandy areas between elevations 6.0 ft and 7.0 ft might be sparsely vegetated by a combination of Panicum virgatum (switchgrass), Ammophila brevilligulata (beachgrass), and Myrica pensylvanica (bayberry). Commercial nursery plant materials of these species are recommended. Regional plant materials or ones obtained from areas south to Virginia would be acceptable to use.

4.21 All of the above plant species with the exception of P. virgatum are found (Taxon, Inc. Biotic Survey) to occur naturally on Cedar Island. Panicum virgatum is found on dunes and sandy slopes from Canada south to the Gulfstates and should develop well throughout the specified elevations on the habitat development site. All of the above species are commercially available.



... of wetland habitats on dredged material containment facility.

AD-A128 227 THE LONG ISLAND SOUND DREDGED MATERIAL CONTAINMENT FEASIBILITY STUDY(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 83 4/5

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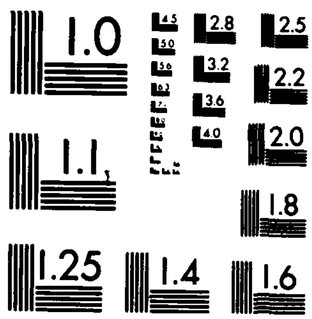

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

4.22 Approximate costs for seeding and transplanting (including fertilization) are $2,500 per acre and $1.25 per transplant, respectively.

4.23 Beneficial Effects of a Marsh Creation

4.24 The creation of additional marsh area as proposed could potentially increase the biological habitat value of the harbor. The additional marsh area would also provide more spawning areas for fish populations as well as increase the amount of spatial resources for salt marsh invertebrates, juvenile fish, and birds. The proposed containment of the DMCF by rip-rap construction would also provide a large amount of surface area for the development of hard-substratum communities. This would increase secondary marine production, providing a greater potential food supply for commercial fish stocks in the Clinton Harbor area as well as a suitable habitat for commercially important invertebrate species (e.g., crabs, lobsters, mussels). The construction of the DMCF as proposed can only enhance the biological value of the area. The greatest potential for enhanced secondary production would be related to colonization of the rip-rap by the blue mussel Mytilus edulis. Production potential for this species is very high and could reach values greater than 200 $g\ m^{-2}yr^{-1}$ (Barnes and Green, 1971).

4.25 Benthic Faunal Survey

4.26 The most widespread species of the 96 taxa collected in the study area (see figure 4.3) during the September 1981 sampling was the polychaete Streblospio benedicti which was present at every station and was collected in 30 (94%) of the 32 samples. The bivalve Tellina agilis was nearly as ubiquitous, occurring in 28 (88%) of the samples and being present at 15 of the 16 stations. The remaining common species were not so widespread, occurring in less than 75% of the samples, and included the polychaetes Glycera americana, Tharyx acutus, Mediomastus ambiseta and Paraonis fulgens and the Oligochaetes.

4.27 The October sampling included 111 species, a 16% increase over September. The two dominant species were again Tellina and Streblospio with Tellina occurring in every sample and Streblospio occurring in 30 samples and being present at every station. Although Tellina was slightly more widespread, Streblospio was generally much more numerous. With the exception of Paraonis fulgens, all of the common species noted above for the September sampling were again common in October. In addition, the polychaetes Nephtys picta and Spiophanes bombyx were very widespread in the study area in October.

4.28 Community Classification

4.29 Four site groups were discerned from the September station cluster analysis. See Figure 4.4.

4.30 Station group 1, including the deeper offshore stations, was characterized primarily by species group II (66.796) and, to a lesser extent, group I (38.196). These two groups include many species which are characteristic of soft mud bottoms in Long Island Sound and include Nucula proxima and Nephtys incisa, the classic Nucula-Nephtys assemblage described by Sanders (1960).

4.31 Station group II, comprising only Nephtys and the mud snail Nassarius trivittatus was common only at station group 1 but species group I was also found at station group 2, the deeper stations in the outer harbor area. This station group included most of the species groups to some extent but was primarily characterized by species groups I, III and V. Station group 3 comprised Stations 9 and 10 and is believed to be representative of the lower intertidal and shallow subtidal areas of the proposed disposal site. The communities in this area were characterized by a high level of occurrence of species from species groups III and IV. Species group III was widespread throughout the outer harbor area and included most of the species described earlier as dominants: Tellina, Streblospio, Glycera, Tharyx, etc.

4.32 Species group IV appeared to contain species which were found primarily in the shallow subtidal and were present primarily at station group 3. These included the polychaetes Paraonis and Scoloplos, and the amphipod Listriella.

4.33 Most of the proposed disposal area was contained within station group 4 which included Stations 11, 12, 13, 15 and 16. These stations form a contiguous broad band between the outer zone of station group 2 and the inner zone of station group 3. This area contained primarily species from species groups III and IV, but group IV was considerably less common here than at the more inshore stations.

4.34 The results of the classification analysis of the October data were, with some exceptions, generally comparable with the results from September. Again, four basic station groupings were discernable from the dendrogram. The first of these, incorporating those samples between 3A and 4A is analogous to station group 1 from the September sampling and includes offshore stations 2, 3 and 4. Station 1 was not included in this offshore group in the October sampling. See Figure 4.5.

4.35 Station group 1, comprising the soft offshore sediments, was characterized by the presence of species group IV and V and the pronounced absence of the species group I. This is generally consistent with the September results since group V contains many of the components of group I from September (i.e., Mulinia lateralis, Nucula proxima, Tubulanus pellucidus). Group IV, however, is similar to group III from September, and comprises species which were generally absent from this area during the first survey. It appears that a shift toward coarser sediments in this area may be responsible for this result.

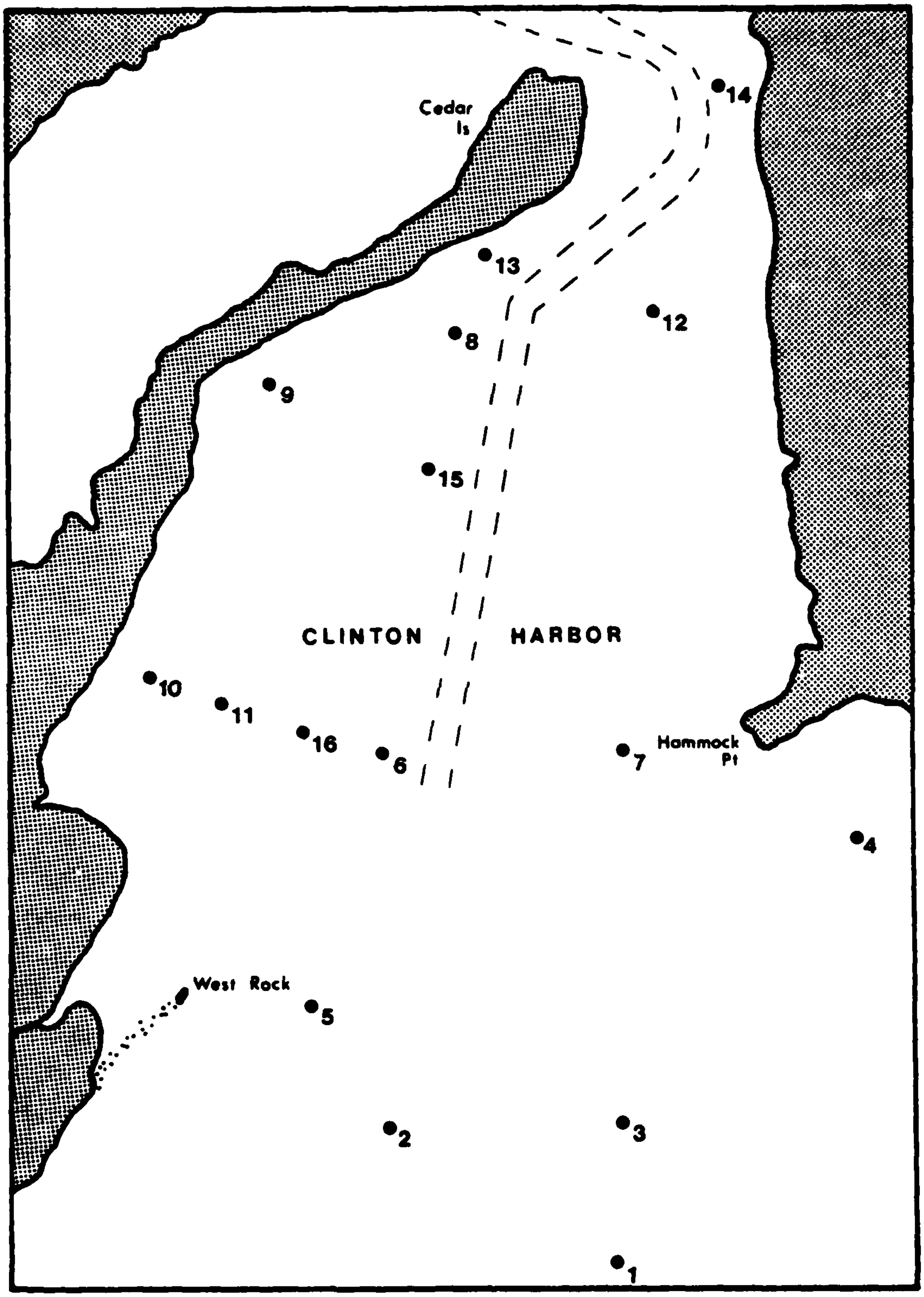

Figure 4-3 Study area and sampling station locations.

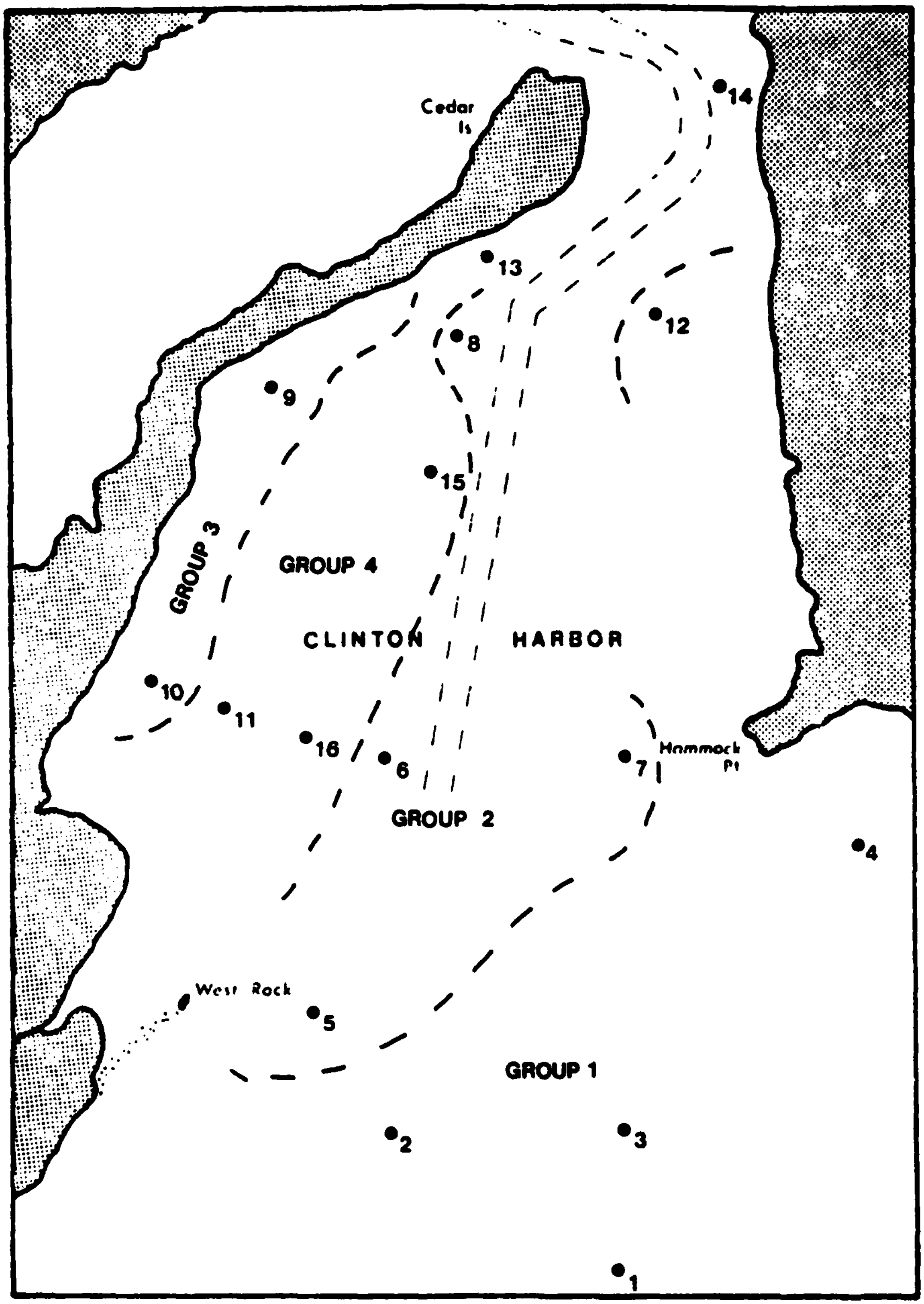

Figure 4-4 Approximate distribution in the harbor of station groups identified from the normal classification analysis, September data.

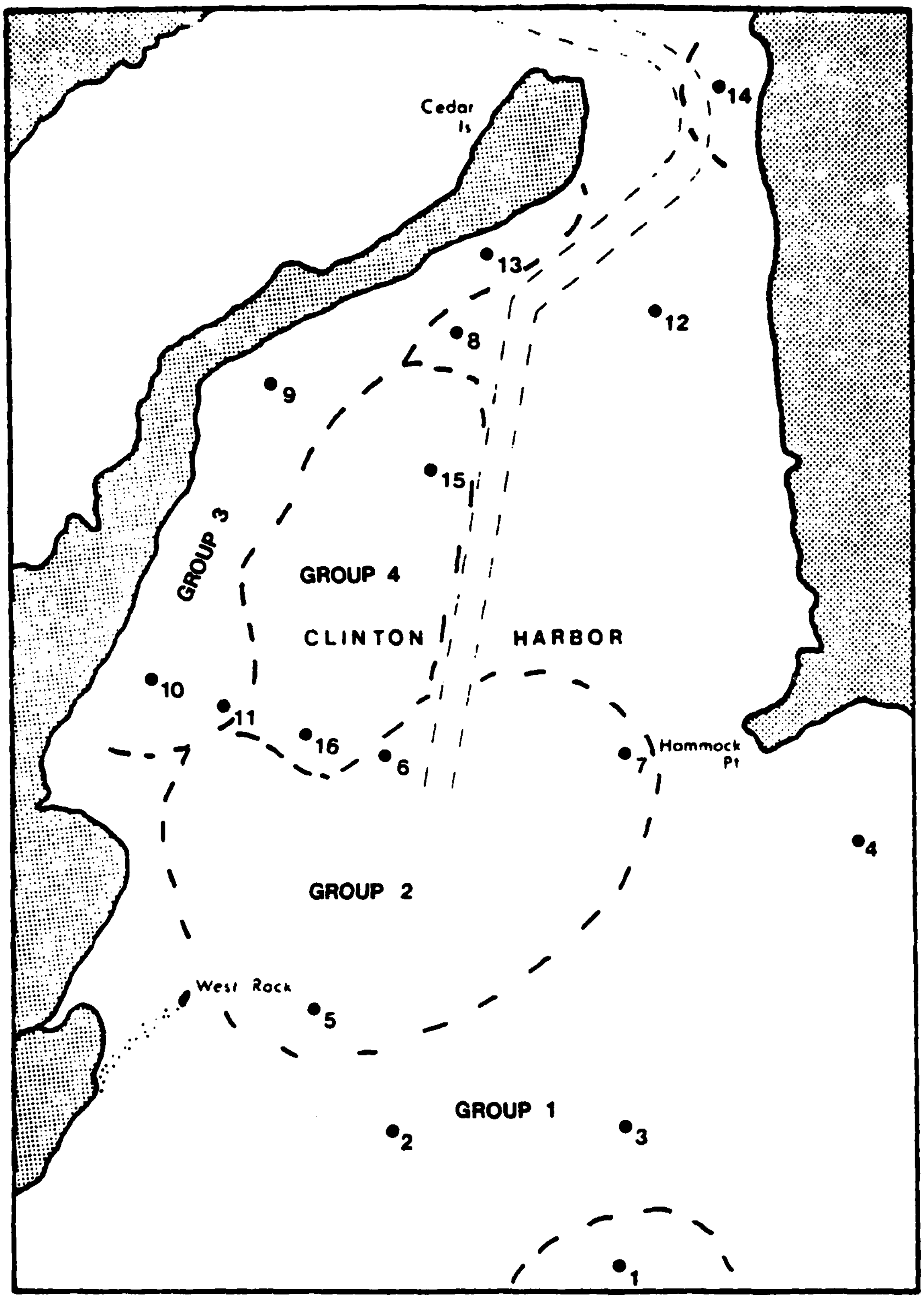

Figure 4-5 Approximate distribution in the harbor of station groups identified from the normal classification analysis, October data.

4.36 Station group 2, in the deeper central area of the harbor, again demonstrated no strong affinity for one particular species group but rather contained most of the species groups at a high level of occurrence. The most characteristic species group in this area, group IV, was present in all areas of the harbor in October, and included many of the species identified earlier as dominants.

4.37 Station group 3, along the shoreline of the proposed disposal area, also included all of the species groups in at least moderate abundance, but with relative occurrences that were different from group 2. Species groups which were very abundant at groups 1 and 2 were markedly less common here, particularly species group IV, which was characteristic of the offshore muds. In contrast, species group VI which was present in only moderate abundance at the earliest areas, was very common inshore. This group was very similar to group III in September which was also most common at these shallow inshore stations.

4.38 The final station group, group 4, occupies the central area of the disposal site and is characterized by high percentages of occurrence of species group III and moderately high occurrence of group VI. In this respect, these stations are intermediate between the inshore and offshore areas in faunal composition as well as location.

4.39 A previous study of Clinton Harbor using techniques identical with those in the present survey and incorporating stations in the outer harbor was conducted by Taxon, Inc., in 1977 (McGrath, et al., 1978). That study included two stations within the proposed disposal area, two stations in the vicinity of the present Stations 6 and 12, respectively, and one station at the site of the present Station 14. In addition, sampling was conducted at the same time of year.

4.40 McGrath, et al., reported a total of 68 species from the 1977 survey, far short of the 145 species collected in the present study. Some of this difference may be attributed to the greater intensity of sampling in 1981 and to the placement of stations in habitat types that were not sampled in 1977. Comparison between the two surveys was much closer for faunal density with overall mean densities of $6,748/m^2$ in October and $6,094/m^2$ in November vs. the $4,833/m^2$ (September) and $13,165/m^2$ (October) in the present survey.

4.41 The dominant species in the harbor in 1977 were identified as *Streblospio benedicti*, Oligochaeta, *Tharyx acutus*, *Scoloplos fragillis*, *Tellina agilis*, *Eusyllis* sp. and *Ilyanassa obsoleta*. All these species were again common in the present study, except that the *Scoloplos* in the present study was identified as *S. acutus* rather than *S. fragilis*. We do not know if this is due to misidentification of specimens from the earlier study or is a real change from one species to another within this genus, although the former explanation appears more likely based on the overall similarity between results from the two studies.

4.42 This pattern of community parameters indicates that Clinton Harbor appears to be a relatively unimpacted and well-balanced estuarine ecosystem. No evidence was found to indicate changes in natural communities due to human activity and there was generally very little evidence of stress due to existing natural conditions. The comparatively low richness and density at some outer harbor stations is evidently related to natural conditions such as sediment type or exposure.

4.43 Shellfish Resources

4.44 No shellfish were found in any of the subtidal shellfish samples. We believe that some hard clam (*Mercenaria mercenaria*) and bay scallop (*Aequipecten irradians*) populations exist in this area but they are either too localized or too sparse to be of possible commercial importance. It is recognized that they may have some minimum value as a recreational resource. In the intertidal area just north of the small tidal creek draining Hammonasset State Park we located a small but moderately dense population of oysters (*Crossostrea*). These were distributed over a mud/shell/ gravel bottom extending a few hundred meters north of the creek mouth. Although the density of this population appeared sufficient to support at least recreational harvesting, the small amount of suitable substratum in the area limits the overall value of this resource. In summary, four species of commercially valuable molluscs are known to , inhabit the proposed disposal area: hard clams, quahogs (*Mercenaria mercenaria*), bay scallops (*Aequipecten irradians*), American oyster (*Crassostrea virginica*) and the softshell clam (*Mya arenaris*). None of these, however, appears to support a commercial, or anything beyond a very casual, recreational fishery.

4.45 Fishery Resources - Finfish and Feeding Habits

4.46 Fifteen different species of the finfish were captured at the trawl stations. Keeping in mind the bias inherent in any finfish sampling technique (gear selectivity, net avoidance capabilities of different species, etc.) as well as the time of the year sampling took place, the dominant species were found to be summer flounder (*Paralicthys dentatus*) and winter flounder (*Pseudopleuronectes americanus*). Though relatively few numbers of summer flounder were taken, their presence at for of the trawl stations establishes them as a dominant species in the Clinton Harbor area. The overall low numbers caught were probably due to the fact that summer flounder are strong and active swimmers and could easily avoid a trawl of small size fished at a relatively slow speed. Younger fish predominate in the population of both summer and winter flounder sampled.

4.47 Five species comprised the nearshore fish community at the six seine stations. Silversides (*Menidia menidia*) were the dominant species. Mummichogs (*Fundulus heteroclitus*) were not considered to be dominants due to their presence at only one of the seine stations.

4.48 Silversides were the most abundant species taken in the harbor, being present in virtually all the seine samples, often to the exclusion of other species. Given the schooling nature of the species, the large number caught at each station is to be expected. This species is relatively short-lived reaching a maximum age of about two years.

4.49 A wide variety of food items was identified in the stomach contents of the dominant fish species. Demersal, as opposed to pelagic, feeders contained the greater variety of food items.

4.50 The sand shrimp (Crangon septemspinosa) was the dominant food source both in frequency of occurrence and percent composition, of the summer flounder. The lady crab (Ovalipes ocellatus) was present in over 33% of the stomachs examined and probably constitutes a major dietary item. Evidence of cannibalism was indicated by the presence of juvenile Paralichthys. Because of the small number of stomachs examined, caution must be exercised in applying the apparent dietary habits of those specimens of summer flounder examined to that of the population in Clinton Harbor.

4.51 Twenty-two different types of food items were found in the 26 winter flounder stomachs examined. Polychaetes predominated, being found in 61.5% of the stomachs. Among polychaetes, species of the family Spionidae were present in the greatest numbers. Given the relative abundance of worms of this family in the harbor, this is to be expected. Glycerid worms were another frequently encountered family, being found in over 23% of the stomachs examined, indicating that winter flounder are also utilizing this abundant group.

4.52 In addition to polychaetes, bivalves were also a major dietary constituent of winter flounder, being found in over 57% of the stomachs examined. The most frequently encountered bivalve was the razor clam (Ensis directus). Tellina agilis occurred in relatively low numbers (11.5%) in comparison with the razor clam. Given the relative abundance of Tellina, it appears that winter flounder selectively feed on Ensis in preference to Tellina. The sand shrimp was the most commonly found crustacean although in terms of total numbers found, its value was relatively small.

4.53 Pelagic copepods dominated in the diet of Silversides (menidia) specimens examined both in terms of frequency of occurrence (74.4%) and percent composition (82.8%). These results indicate that copepods are the principal food source for silversides; numerical percentages of other food items were negligible.

4.54 Marsh Plant Survey

4.55 Two areas of Hammonasset Marsh were chosen as study sites: Hammonasset State Park, located near a tidal creek close to the southwestern limit of the proposed DCMF; and Cedar Island, at the northern tip of Hammonasset Marsh, near the center of the project area.

4.56 Six species of marsh plants, representing four taxonomic families, were present in the collections from the Hammonasset State Park site.

4.57 The grasses *Spartina patens* and *S. alterniflora* were the dominant species in this community, occurring at six and seven of the ten quadrats, respectively. *S. patens* was restricted to higher areas of the transect where normal tidal elevations do not reach. Live biomass of this species from 38.4g to 548.g dry weight/m^2 and litter was present in amounts ranging from 2.4g to 678.g dry weight/m^2.

4.58 *Spartina alterniflora* occupied the lower supratidal quadrats on the transect, as well as the intertidal zone. Biomass values ranged from 28.6g to 295.5g dry weight/m^2; litter does not accumulate in these areas due to tidal action.

4.59 Of the two species, *S. patens* had higher densities, ranging from 768 to 9,376 plants m/^{2} in those quadrats where it was found. *S. alterniflora* densities were approximately one order of magnitude lower, varying from 32 to 1,040 plants/m^2.

4.60 Seventeen species representing 12 taxonomic families were identified at the Cedar Island site. The species composition and zonation patterns of this area were typical of New England salt marshes as described by Chapman (1940) and Redfield (1972).

4.61 The area of the marsh bordering the Hammonasset River was occupied almost exclusively by *Spartina alterniflora*, intermixed in the intertidal area with *Salicornia europaea* and *Limonium carolinianum*. These latter two species were also found on the high marsh in water-filled depressions.

4.62 At about the high tide level, this community was replaced by an association of *Spartina patens* and *Distichlis spicata*. The inner marsh was dominated by these two grasses and a rush, *Juncus gerardi*, which occurred in pure stands in the drier areas. Also occurring on the high marsh were *Spergularia marina*, *Plantago sp.*, *Solidago tenuifolia*, and *Iva frutescens*. Colonies of the common reed, Phragmites communis, as well as pure stands of *Rhus radicans*, inhabited the edge of the upper marsh. The marsh-dune interface was occupied by *Myrica pensylvanica*, *Cakile endentun*, *Euphorbia polygonifolia*, *Lathyrus japonicus* and *Ammophila breviligulata*.

4.63 Algal and Marsh Plant Community

4.64 Intertidal habitat suitable for algal colonization was found in only 5% of the survey areas. Three different habitat-types were identified, each supporting its own distinct algal community. These have been termed the rock substratum algal community, the salt panne algal community, and the tidal creek algal community.

4.65 The Rock Substratum Algal Community

4.66 The occurrence of rocky intertidal substratum was restricted to a small area bordering on Hammonasset State Park at the far western periphery of the outer harbor region. The area consisted of a large, seaward-facing, rocky outcrop together with a lengthy dike. The dike served to separate the outer harbor from Long Island Sound.

4.67 The rocky outcrop consisted of continuous rock substratum from the high to the low intertidal zones, continuing out into the subtidal region. The high and mid zones were of extremely high relief and consisted of rounded, well-weathered boulders of moderate to large size. The low intertidal and shallow subtidal zones were of a more gradual relief, and comprised smaller boulders together with rocks and cobble of various sizes.

4.68 The south-facing outer side of the rock dike was of moderately high relief at all intertidal elevations and was composed primarily of medium sized boulders and large rocks.

4.69 The high and mid intertidal regions of both the rocky outcrop and the rock dike were only sparsely and irregularly colonized with intertidal algae. Approximately 75% of the rocks and boulders were completely devoid of algal growth. Representatives of only five green algal species were encountered: *Ulothrix flacca*, *Blidingia minima*, *Enteromorpha linza*, *E. prolifera*, and *Ulva lactuca*. Quantitative sampling techniques were not utilized because of this lack of algal cover. However, a qualitative examination of a representative sample indicated that *Blindingia minima* and *Enteromorpha linza* were the more common of the five species. Individuals of all species were small in stature, with most being no more than 2-4cm in length. The diminished level of algal colonization in the higher intertidal zones is believed to be due to the increased exposure associated with high relief habitats. Many plants observed evidenced the frayed apices indicative of high exposure conditions.

4.70 The low intertidal and shallow subtidal regions of the inner side of the rock dike also had minimum algal cover. The sand and mud, which constituted the greater portion of the substratum, supported no algal growth and algal colonization was restricted to the surfaces of the small number of protruding rocks and boulders. Only four very sparsely distributed species were encountered: the macrophytic red algae *Chondrus crispus* and *Gigartina tellata*, and the smaller algae *Ulva lactuca* and *Enteromorpha intestinales*. The reduced level of algal colonization was due to the sand and mud substratum, as algal germination is known to be inhibited by the presence of either. Sand and mud also continuously abrade the holdfasts of juvenile and mature individuals, thereby increasing the susceptibility of the plants to dislodgement from the substratum.

4.71 The Salt Panne Algal Community

4.72 Salt pannes are the marsh equivalent of tide pools, and occur as shallow depressions in the surface of living or decayed salt marshes. The formation of the panne commonly occurs as a consequence of localized erosion within the marsh. Once formed, pannes serve as repositories for shells and cobble. The accumulated shells and cobbles, in turn, serve as substratum for algal colonization.

4.73 The salt pannes of the outer Clinton Harbor intertidal region are associated with a decayed marsh which presently lies buried beneath sand and cobble. Intermittent breaks in the sand/cobble cover have resulted in the exposure of sections of the underlyir ırsh and their associated pannes. Pannes were observed throughout outer harbor survey area, but were found to occur in greatest numl at the mid and low intertidal levels of the southern sections of the ·oreline. The average panne was 1-2m^2 in size and 7-10cm in depth. proximately 20-40% of each panne consisted of potential algal substratu e most common suitable materials were small cobbles, slipper shells epidula), and surf clam shells (Spisula).

4.74 The salt panne algal community had very low species richness. A total of only eight species was recorded over the five replicates sampled. These consisted of six members of the Chlorophyta and one member each of the Phaeophyta and Rhodophyta.

4.75 The dominant members of the salt panne community, as determined by percent cover and the total number of occurrences, were the green algae (Cladeohora albida, Enteromorpha intestinalis, and Ulva lactuca.) Each of the three was collected from all five replicates, and frequently occurred as relatively well-defined populations within each replicate.

4.76 The Tidal Creek Algal Community

4.77 The tidal creek algal community was characterized by relatively low species diversity. The five replicates sampled generated a combined total of 14 species; of this number, six species were members of the Chlorophyta, and eight were members of the Rhodophyta. The number of species collected from the individual replicates ranged from eight to ten. Algal cover for each of the five replicates measured between 12-52% of the available substratum.

4.78 The mascroscopic red alga (Gracilaria foliifera) was the dominant species, occurring in all five replicates sampled. For the five replicates, Gracilaria occupied between 12% and 24% of the available substratum. Gracilaria also appeared as the most well developed of the resident species, commonly attaining a height of 20-30 cm. The green alga Ulva lactuca was the major subdominant species. Ulva occurred in all five replicates and covered up to 12% of the available substratum. Additional species which formed important components of the benthic flora were the

red carrageenoid alga Chondrus crispus and the green alga Enteromorpha clathrata. The epiphytic algal population was dominated by Polysiphonia harveyi and Ceramium rubrum, with Gracilaria serving as the principal host species.

4.79 Conclusions The following conclusions have been extracted from Taxon's reports of March and June 1982 which discusses the results of the environmental base line surveys at Clinton Harbor.

4.80 The hydrodynamic simulation indicated that tidal current patterns and flushing characteristics of the Harbor do not appear to be detrimentally altered by the proposed development. The most significant effect of DMCF construction would be an increase in tidal velocities in the outer harbor. This increase would be on the order of 2x to 3x and would presumably increase sediment transport in this area. Data developed by the biological habitat evaluation study indicate that most sediments in the outer harbor area are particularly unstable under present conditions with sediments to the east of the channel, where tidal velocities would be most increased due to DMCF construction, appearing to be at the point where such changes in tidal velocities could produce significantly increased sediment transport. The exact nature and effects of this increased transport could not be evaluated within the scope of the present study. Also, the model employed for the simulation did not incorporate representations for wave-induced turbulence and mixing, factors which could be of considerable importance and which must be evaluated in order to adequately assess circulation and transport changes.

4.81 Within the area of the outer harbor which would be occupied by the proposed facility, sediments were also determined to be unstable and in a state of chronic minor, and periodic major, resuspension. This type of bottom does not allow the establishment of complex, balanced biological communities and the resident macrofaunal community in this area was generally characterized by species known as Stage I colonizers which are capable of rapid exploitation of a substratum following physical disturbance. These include the polychaete Streblospio benedicti and the bivalve, Tellina agilis, which may be considered the dominant species in the proposed disposal area. In addition, this type of bottom is usually unsuited to the development of commercially valuable populations of edible shellfish, and no significant populations were found during the course of this study with the exception of a small oyster population at Hammonasett State Park.

4.82 Although some communities with characteristics similar to those at Clinton can exhibit elevated productivity, this does not appear to be true in this case. Based upon biomass and life-history data, the estimated annual production in the study area was approximately 10.5 g C $m^{-2}yr^{-1}$, a value which is relatively low in comparison with other Stage I assemblages in Long Island Sound. It appears, then, that the frequency of physical disturbance in this area is sufficient to limit its value as a habitat. Although it was demonstrated that the species within the area

are utilized as food by demersal fishes in the harbor, primarily winter flounder, the low secondary production in the benthos indicates that any impacts to finfish via removal of this food resource would be minimal.

4.83 The area was determined to have high potential for biological enhancement through the establishment of a marsh on the deposited spoils. This enhancement would occur in several areas, the most notable of which include: (1) the marsh proper, which would incorporate over 60 new acres of Spartina alterniflora (i.e., low marsh) habitat, an extremely productive habitat type which is not presently common in the outer harbor area; (2) nearly 30 acres of shallow subtidal inlet-type habitat, providing area for fish spawning and stable bottom for colonization by productive benthic macrofaunal communities; and (3) nearly 5000 linear feet of rock breakwater, one face of which would provide hard bottom suitable for colonization by an extremely rich and diverse macrofaunal community in addition to habitat for various species of potential commercial importance (lobsters, mussels, crabs).

4.84 The investigations undertaken to date indicate no serious adverse impacts from the proposed DMCF construction and have identified several projected benefits. Additional studies must be conducted to ensure that adverse impacts will not occur from effects which were outside the scope of the present study. Chief among these would be the potential for large-scale sediment alterations due to increase tidal velocities and diversion of wave energy to other areas of the harbor. To that end, the New England Division Corps of Engineers has contracted the Center for the Environment and Man and Dr. Frank Bohlen, U. Conn. to determine the potential impacts of a containment facility at Clinton Harbor on wave refraction and diffraction patterns and subsequent changes in sediment erosion or deposition patterns, channel shoaling rates, the marsh habitat assuming one were created and local benthic populations. The results of this study will be incorporated with the Stage III report phase.

4.85 Additional benthic sampling was undertaken in June 1982 to document the characteristics of the resident hard-bottom benthos in the harbor in order to develop information on the proposed containment breakwater. The data indicates that such a community would be rich in both density and diversity than the present soft-bottom community, and would share many of the same species.

4.86 Although it is not possible to address seasonality in the Clinton Harbor infauna on the basis of essentially two seasonal collections, we now know that the benthic communities in the proposed containment disposal area do not appear to change radically between Spring and Fall. The results of this survey indicate that most of the species which have been described as important faunal components in previous collections are also present in the Spring but that, in some cases, their positions as dominants in the community are taken over by other related species.

4.87 The actual taxonomic composition of the infaunal communities on a seasonal basis is probably of less importance for the Clinton Harbor system than the community parameters of species richness, faunal density, and diversity. If we view the benthos as secondary producers whose role in the ecosystem is to convert energy into forms which become available to higher trophic levels, then it is apparent that, in general, the seasonal change from dominance by one species to dominance by another related species (for example, from Streblospio to Scolecolepides in the present case) is of less significance than large changes in the numbers of organisms present.

4.88 When viewed from this perspective, the amount of seasonality evident at Clinton is minimal. The present collections indicate moderate increases in species richness and faunal density in these infaunal communities but these changes are not of sufficient magnitude to alter the functional relationships between the benthos and other components of the ecosystem.

4.89 The resident hard bottom biotic community at Clinton Harbor is typical of such habitats throughout New England. The red algal species *Chondrus crispus* and *Phyllophora truncata* (collectively harvested in some areas as Irish moss) were dominant algae at all sites and both the algal and faunal components of this habitat had elevated species diversity and standing stocks.

4.90 The ecological value of this type of community is multifaceted. The high algal density produces a zone of benthic primary production which is essentially absent from soft bottom communities. The physical nature of the algal cover, particularly the dense mat produced by *Chondrus* and *Phyllophora* creates an ideal breeding and foraging habitat for many faunal species producing much greater population densities than would otherwise be possible. The creation of additional habitat of this kind at Clinton would be one of the unquestionable benefits of the proposed containment facility construction.

4.91 In comparison to a similar Long Island Sound hard bottom community for which similar data are available, Black Ledge - New London Harbor (McGrath et al., 1982a), the algal populations at Clinton were found to be of considerably greater ecological value. Algal populations at Black Ledge were adversely impacted by a dense population of mussels (*Mytilis edulis*) which prevented the establishment of a healthy *Chondrus*/*Phyllophora* community. Although this resulted in greater algal species diversity, the increase was among the small epiphytic species which do not contribute significantly to the habitat value of the community.

4.92 The hard bottom faunal community at Clinton was generally more diverse than that at Black Ledge, again due to the overwhelming dominance of mussels at the latter site. As a result, although population densities were higher at Clinton, the amount of living biological material was

greater at Black Ledge. In both cases, however, the rock communities supported far greater standing stocks than the surrounding soft bottoms, and it is expected that, for equivalent area, the surface of an artificial rock breakwater at Clinton would also be far more productive and ecologically valuable than the soft-bottom it would replace.

4.93 Black Ledge - Prototype Containment Island

4.94 The proposed DMCF site at Groton-New London, shown in Figure 4-6, is located approximately one mile outside of the entrance to New London harbor, to the east of the harbor entrance channel. The site comprises a rocky shoal area known as Black Ledge where water depths rise rapidly from the surrounding 20'-30' (MLW) to less than 10' over much of the shoal. A small pile of rocks approximately $10m^2$ near the western limit of the ledge is exposed at most tidal elevations. The total area of the shoal (depths within the 18' isobath) is approximately $320,000m^2$, or about .1 square mile.

4.95 The Black Ledge site was recommended by the city of Groton Conservation Commission and Harbor Study Commission (Letter Nov. 21, 1977 and April 12, 1979). The area is reported to be a navigational hazard to recreational boating and of minimal value for fishing and lobstering. Proposed benefits of a DMCF island at the site include the establishment of a preserve for controlled ecological studies and storm protection for the southern shore of the city of Groton and long term disposal facility for Thames River/New London Harbor and vicinity dredged materials.

4.96 Because of the exposed nature of this site and evidence of strong scouring on the ledge and even beyond the 30' isobath the design for dredge material disposal would be one of total containment within a rock breakwater. The facility, therefore, would represent an artifical island creation type of project with a stone dike required on all four sides. A containment facility island was considered at this same site by the Navy in its supplement to final EIS (1976) concerning dredging in the Thames River. It was stated in the report that a "steel pile containment structure approximately 1.5 miles in perimeter" would be required along with the "deposition of between 60,000 and 100,000 cubic yards of riprap material." The riprap, it was stated, "would be placed on both sides of the piles." While no precise cost estmates nor designs were attempted, this disposal alternative was rejected on being "not economically feasible" and creating "an additional navigation hazard."

Sampling Methodology and Sample Station Locations

4.97 The five soft-bottom stations were sampled on 31 August 1982; macrofaunal sampling and REMOTS photography were conducted simultaneously to ensure consistency of station location. Two replicate samples were collected at each station with a $0.04m^2$ modified VanVeen grab. All samples were immediately processed through a 0.5mm sieve. An aliquot for sediment grain-size analysis was removed from each grab prior to

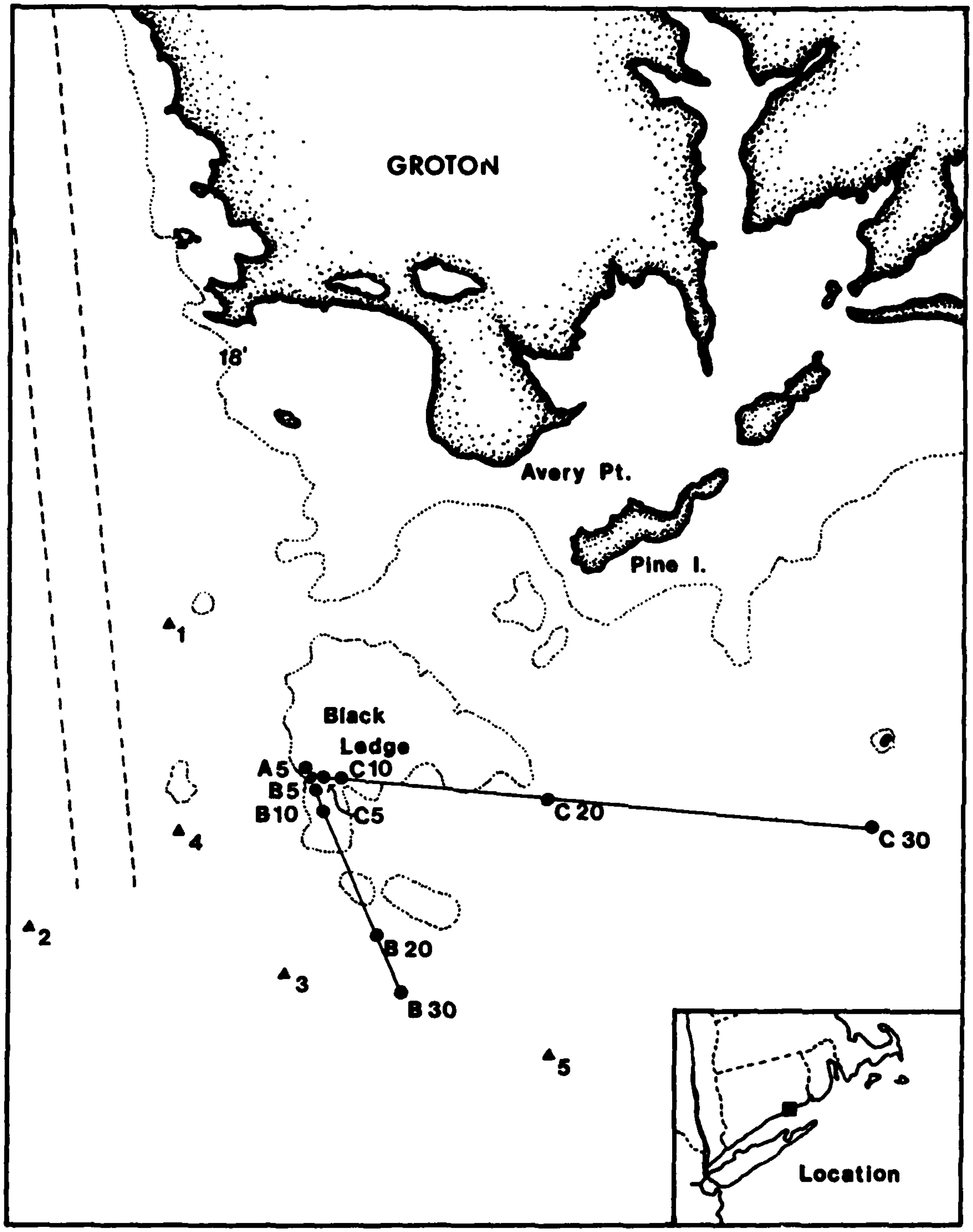

Figure 4-6 Black Ledge Project study area location, showing extent of ledge (18' isobath), relationship to shoreline and harbor channel, and stations sampled.

sieving. Up to six replicate sediment profile images were obtained per station at Stations 1 - 4; the nature of the substratum at Station 5 did not permit REMOTS imagery.

4.98 SCUBA sampling of transect stations was conducted on 16 October and 3 November 1981. At each of the deeper stations, sampling was first attempted with the grab sampler. If sufficient penetration was obtained, no diver samples were collected. When sampling by grab was not possible, a team of divers collected two replicate samples using a $0.1m^2$ pipeframe quadrat and air-lift suction device fitted with a 0.5mm mesh Nitex bag. At stations with gravel substratum, the bottom within the quadrat was excavated with the air-lift to a depth of 10cm; at rock stations, all algal and faunal material within the quadrat was scraped off the rock and suctioned into the collecting bag.

Substratum

4.99 Bottom substrata in the Black Ledge vicinity fall into three general categories: rock, sand/gravel, and silt/clay. The distribution of these bottom types in the area samples is shown in Figure 4-7.

4.100 On the ledge, the bottom consists of large angular boulders with general flat sides; these are evidently not of natural origin, and it was apparent that much of the exposed portion of Black Ledge was transported to the site as riprap. The placement of these is such that crevices and small caves are abundant, providing a variety of microhabitats. All of the 5' and 10' transects stations had rock substratum and this bottom type is characteristic of the shallower shoal areas.

4.101 Sand/gravel substratum was found at the 20' and 30' transect stations to the east and south of Black Ledge. Station C30 was markedly sandier than the other three and was sampled by grab; thus, grain size data are available. The substratum at C30 was a muddy sand of 0.23mm diameter with approximately 12% silt-clay content. The complete grain-size frequency distribution for all soft-bottom stations is provided in Appendix 3.

4.102 Sediments at the grab stations 1 - 4 were silts with substantial (up to 35%) amounts of fine sand. Median grain size at these stations ranged from 0.020mm to 0.028mm and the general pattern of the frequency distributions was similar among the stations. Station 5, to the southwest of the ledge, was intermediate between the sandy transect stations and the silts, and had a poorly-sorted substratum of about 40% silt/clay intermixed with fine and some coarse sand.

Species Composition

4.103 Thirty macrofauna samples collected from Black Ledge contained 184 taxa representing all major taxonomic groups. This is an extremely extensive list for the number of samples processed and is indicative of the variety of the habitats (substrate types) sampled.

4.104 Polychaetes were the dominant faunal group, comprising 76 species, or 41.3% of the total species list. Molluscs and crustaceans were approximately equal in diversity, being represented by 46 (25.0%) and 48 (26.1%), respectively. Amphipods were particularly numerous among the crustaceans; this was related to the extensive algal/mussel mats at the rock stations which provide ideal habitat for a wide variety of amphipod species. This factor was probably also responsibile for the extensive inventory of gastropods.

4.105 When the extent of the Black Ledge species list is compared with those from some recent surveys of northern Long Island Sound estuaries, the diversity of the area becomes even more striking. In a recent survey of Black Rock Harbor and Bridgeport Harbor (CEM, 1981) a total list of 123 taxa was reported. That study was much more extensive than the present survey, including two seasonal collections at 64 stations distributed over a much greater area. Too, in a survey of Clinton Harbor also associated with the potential creation of a DMCF, McGrath et al. (1982) reported 145 taxa from 16 stations which were sampled twice. Hartzband et al. (1979) reported 302 taxa from New Haven harbor from a very extensive program encompassing two laboratories, nearly 30 stations, and intensive sampling over several years.

Species Richness and Faunal Density

4.106 Species richness, varied from 20 to 60 taxa per station ($x = 35.7$). The shallow rocky substratum stations typically supported fewer taxa ($x = 29.4$) than either the sand/gravel stations ($x = 44.4$) or the silt/clay stations ($x = 35.1$). Because of the difference in sample size, it is not possible to determine whether the silt/clay or sand/gravel group supported more taxonomic variety per unit area. The difference between the rock and sand/gravel stations can be tested statistically because both were sampled with the air-lift method. Species richness at the sand/gravel stations was found to be significantly greater at $p<.01$.

4.107 The pattern of faunal density, shown in Figure 6, did not follow that described above for species richness. The silt/clay substratum stations had greatest densitites ($x = 36{,}672/m^2$), followed by the rock stations ($x = 9{,}907/m^2$) and the sand/gravel stations ($x = 7{,}311/m^2$). These values do not exhibit the extreme variation between stations typical of areas which are receiving anthropogenic impacts in the form of organic overenrichment. In Bridgeport and Black Rock Harbors (CEM, 1981), stations receiving the most acute impacts were azoic or supported very few species and individuals. At Black Ledge, no areas with faunal characteristics approaching this type of situation were found. Greatest faunal densities at Bridgeport and Black Rock were found at stations adjacent to the zone of more acute impacts in sand/gravel sediments. Faunal populations in these areas comprised predominantly Stage I polychaete species. At Black Ledge, greatest densities were in silt/clay strata which were not in proximity to any azoic areas. The elevated densities in these areas were due to extremely dense populations

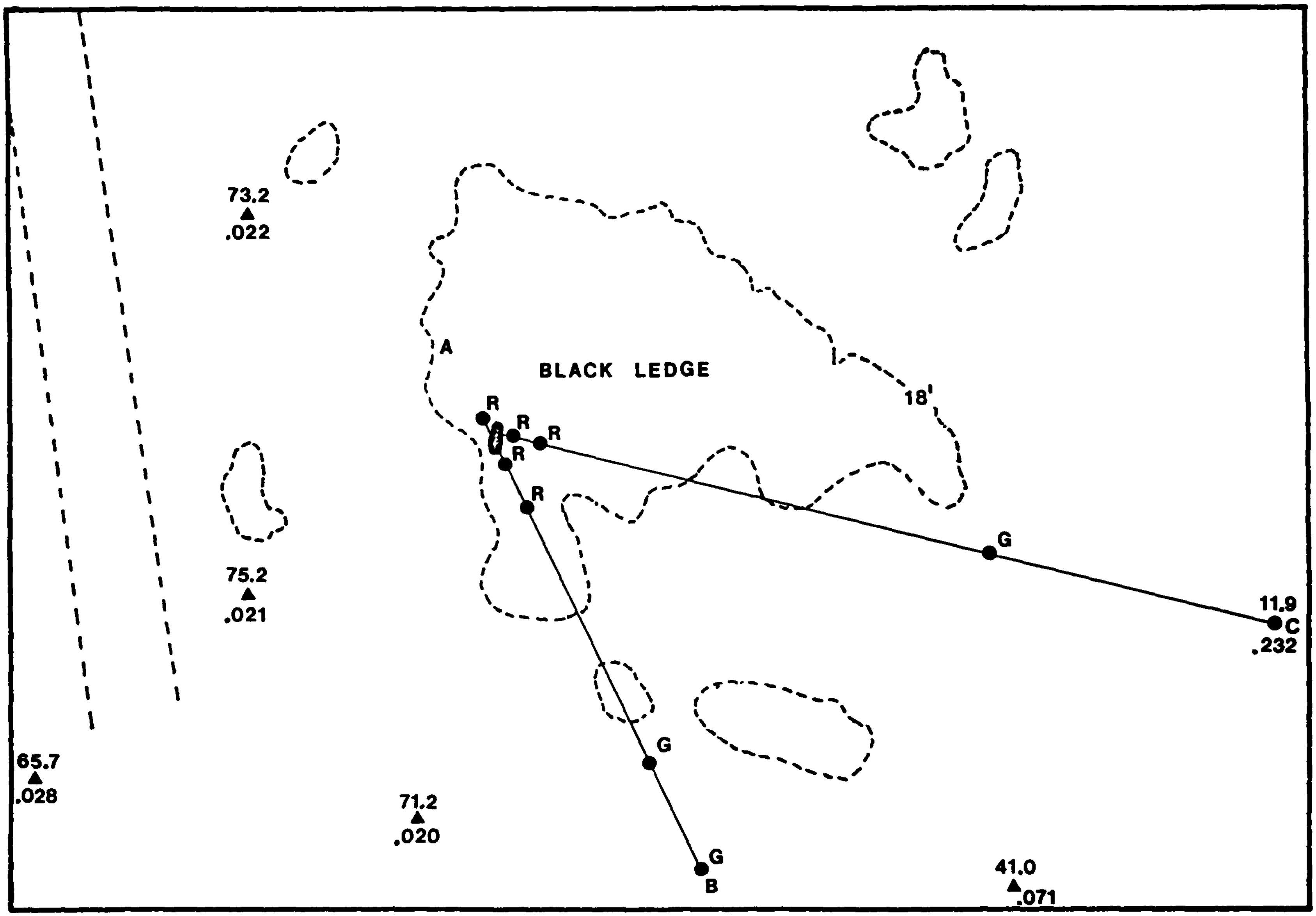

Figure 4-7: Substratum characteristics: % silt/clay (above station point), median grain size in mm (below station point). For stations which were sampled by divers: R = rock substratum, G = gravel substratum.

of the amphipod Ampelisca abdita, a Stage II species, and the polychaete Aricidea sp., which is not considered to be a Stage I species.

4.108 Shannon-Wiener species diversity (H') and evenness (J') are shown in Table 3. As is typically the case with these indices, diversity was not strongly related to the species richness of the communities sampled ($r = .1044$) but was very dependent ($r = .5856$) on J', which is considered to be a measure of how evenly resources are partitioned between the various species. The relationship of eveness to diversity must be considered when interpreting a set of diversity values, particularly when large differences in evenness are apparent between stations, as is the case for the Black Ledge data.

4.109 Because of this relationship between diversity and evenness, the deeper silt/clay substrata stations, where dense populations of Aricidea sp. or Ampelisca abdita occurred, generally had low diversity values (<2.2) in spite of their moderately high species richness and extremely high faunal density. Evenness values in these areas were typically less than 0.45, indicating that most of the contribution to the overall faunal density was by a few dominant species.

4.110 Diversities at the shallow rock substratum stations were higher than at the silt/clay stations despite the depressed species richness and markedly lower faunal density found in the former area. Evenness values were sufficiently higher here to explain this result. In addition, all faunal community parameters were more variable in this area, reflecting the greater spatial heterorgeneity inherent in a shallow hard-bottom habitat.

4.111 The intermediate depth sand/gravel stations on the transects to the southeast of Black Ledge, although they had the least dense faunal populations, had the highest diversities. This was primarily due to the elevated evenness values in this area (>.70) in combination with the high species richness noted earlier.

4.112 The observed patterns of species richness, faunal density and species diversity, when all three parameters are considered, appear clearly related to bottom stability. The shallow hard rock substrata are occupied by a community of low species richness and standing stocks which display marked spatial and, presumably, temporal variation. The intermediate depth sand/gravel substrata in the area support a transitional community which has low standing stocks but elevated species richness and diversity. The relatively greater spatial and temporal homogeneity at the deeper silt/clay stations results in a community with elevated species richness and standing stock, but depressed diversity due to strong dominance by one or two species.

Community Classification

4.113 A classification, or cluster, analysis was performed using data on dominant species. A dominant species was defined as one which occurred among the top five numerical dominants in a least two replicates; 26 species (or taxa) qualified under that criterion.

4.114 These are six recognizable clusters among the 26 species. The first group (A) includes the polychaetes Aricidea sp., Mediomastus ambiseta and Nephtys incisa, and the bivalve Nucula proxima. A second, somewhat related group (B) includes two amphipod species, Ampelisca abdita and Corophium bonelli, and Anaitides maculata, a polychaete. The largest group (C) occupies the center of the dendrogram and includes the polychaets Exogone sp., Polycirrus sp., and Capitella capitata, the oligochaetes, Polygordius sp., an archiannelid, and the tanaid Leptochelia savingyi. The (C) group is followed by the related group (D) which comprises the amphipods Unciola irrorata and Ampelisca vadorum and the polychaete Spiophanes bombyx. All four of the preceding groups were more closely related to each other than to the two following groups.

4.115 Group (E) included the gastropod Mitrella lunata, the bivalve Mytilus edulis, and the polychaete Lepidonotus squamatus. The related group (F) comprised the gastropod Anachis avara, the polychaete Harmothoe imbricata and the anthozoan Metridium senile.

4.116 Species Group A, dominated by Aricidea sp., was restricted to the deep silt substratum stations, being most commonly found at station Group 1, but also occurring at Group 3. Species Group B, dominated by Ampelilsca abdita, was characteristic of the deepest stations (Group 3) and occurred nowhere else. Based upon this pattern, these stations are clearly unique in relation to the remainder of the area surveyed.

4.117 Station Group 2, the moderately deep sand/gravel stations, was dominated by species Group C, but also contained moderate densities of Group D, containing species which appeared to be transitional between the shallower hard substrata and the deeper silt/clays. Species Group E and Group F were characteristics of the rock stations, with Group F being more strongly restricted to this habitat than Group E.

Habitat Valuation

4.118 Three distinct community types were identified from the classification analysis; one of these (silt/clay) was further divided into two sub-classes. Four of the five stations grouped into the silt/clay group were sampled via REMOTS methodology in addition to the conventional macrofaunal sampling, and therefore more data are available for the habitat analysis of the program. The results of the analysis of the REMOTS imagery are shown in Table 4-1 and Figure 4-8.

Table 4-1: Scores by station and replicate for parameters used in evaluating imagery obtained by REMOTS photography.

Station	Sediment Type	P	Redox(cm^2)	CH_4	Successional Stage	Habitat Index
1-1	4 - 3Ø	4.6	19.2	no	I	3
1-2	4 - 3Ø	5.1	27.5	no	I	4
1-3	4 - 3Ø	4.6	26.6	no	I	4
1-4	4 - 3Ø	4.6	28.9	no	I	4
1-5	4 - 3Ø	4.8	23.2	no	I	4
2-1	4 - 3Ø	3.9	30.8	no	I	5
2-2	4 - 3Ø	4.3	19.6	no	I	3
2-3	4 - 3Ø	3.5	34.1	no	I	5
2-4	4 - 3Ø	4.2	33.1	no	I	5
2-5	4 - 3Ø	3.9	21.5	no	I	4
2-6	4 - 3Ø	4.8	28.2	no	I	4
3-1	4 - 3Ø	4.0	37.0	no	II	7
3-2	4 - 3Ø	3.9	41.3	no	II	8
3-3	4 - 3Ø	3.9	40.2	no	II	8
3-4	4 - 3Ø	3.9	39.1	no	II	7
3-5	4 - 3Ø	4.0	37.3	no	II	7
4-1	4 - 2Ø	4.1	44.0	no	II	7
4-2	4 - 2Ø	5.2	31.8	no	II	7
4-3	4 - 2Ø	3.0	36.3	no	II	6
4-4	4 - 2Ø	4.2	41.0	no	II	7
4-5	4 - 2Ø	4.8	60.3	no	II	8

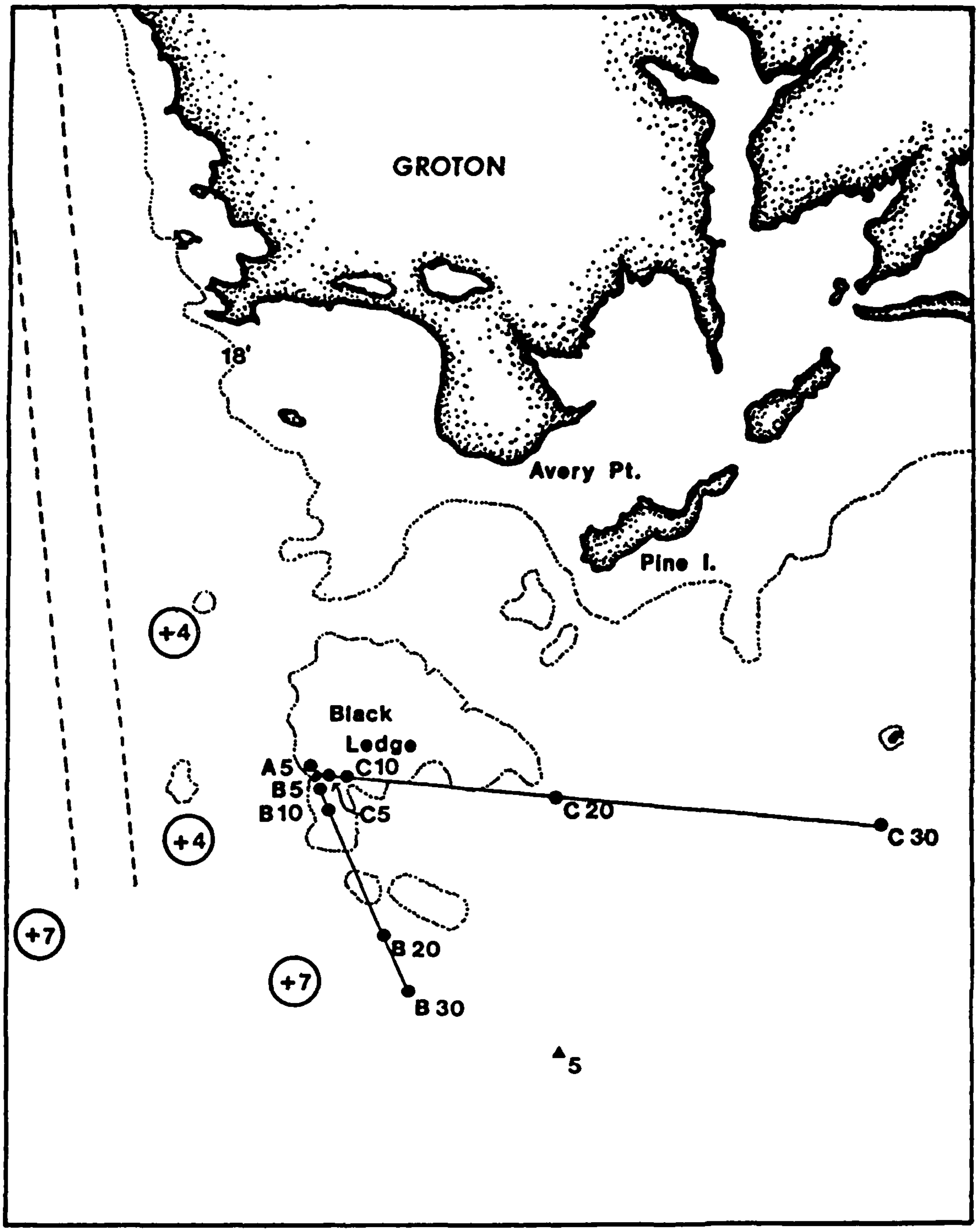

Figure 4-8 Plot of habitat index scores for four stations at Black Ledge evaluated by REMOTS imagery. Scale ranges from -10 to +10.

4.119 Stations 1 and 2 were unlike any other stations and comprised a silt/clay substratum dominated by a suite of polychaete species, primarily the paraonoid, *Aricidea* sp. Also common were the polychaetes *Scoloplos acutus* and *Tharyx acutus*. The most common non-polychaete species was the bivalve *Nucula proxima*. REMOTS imagery indicated that these stations had an average oxidized area of approximately 25 cm^2 with no sediment methane. Although the dominant polychaete in this assemblage (*Aricidea*) is not one of the more typical Stage I species, the remainder of the community is indicative of Stage I (polychaete-dominated) succession.

4.120 Based upon the habitat evaluation procedure described earlier, this area was awarded a habitat index of 4 - 5, with Station 2 scoring slightly higher than Station 1. These are relatively high indices for this community type and suggests that the area has not been subjected to a great amount of pollution-related stress. More typical Stage I assemblages, in heavily polluted regions of harbors, have habitat values of 1 to 3.

4.121 The remainder of the silt/clay substratum stations (3, 4, 5) supported faunal communities dominated by the ampeliscid amphipod, *Ampelisca abdita*. Prominent sub-dominant species included *Nephtys incisa*, *Nucula proxima*, *N. delphinodonta* and *Mitrella lunata*. Although there was no discernable difference in sediment type between the two silt/clay community types, the amphipod-dominated community definitely presents a picture of greater stability.

4.122 REMOTS imagery from Stations 3 and 4 also indicated a lack of methanogenesis and a considerably larger oxidized layer than Stations 1 and 2 ($x = 42.5 cm^2$). Primarily because of the Stage II amphipod-dominated community at Stations 3 and 4, this area received a higher habitat index of 7 - 8, with no difference between the two stations. Although Station 5 was not sampled with the REMOTS methodology, it is clear from the similarity in the faunal and sediment composition that this station would also receive a similarly high index.

4.123 The four sand/gravel substratum stations (B20, B30, C20, C30) represent a heterogeneous group of faunal assemblages which have characteristics of both Stage I and Stage II communities. Polychaete species dominate most of the samples from stations, particularly at B20 and B30, but crustaceans are also common and *Ampelisca abdita* is one of the dominants at Station C30.

4.124 It was not possible to obtain REMOTS imagery at these stations due to the nature of the substratum and the program scope. Therefore, it is not possible to assign a habitat index value which can be compared directly with those assigned to the silt/claly stations. Based upon the faunal assemblages at these locations, however, it appears that the sand/gravel stations would have indices intermediate between the Stage I and Stage II silt/clay stations. Stations on the B transect, which were more strongly polychaete-dominated, would score toward the lower end of

this range while stations on the C transect, with their larger crustacean components, would be ranked toward the upper end of the range.

4.125 The remaining five stations (A5, B5, B10, C5, C10) are all located on the shallower area of Black Ledge and share a rock substratum. These stations are occupied by a faunal assemblage which is entirely different from that described at the deeper stations. The dominant species in all cases was the edible mussel, Mytilus edulis, and subdominants included the gastropods Mitrella lunata and Anachis avara (brittle starfish), the polychaete Harmothoe imbricata and the ophiuroid Amphipholis squamata. These are all typical hard-substratum species with a wide distribution in the northeast littoral.

Algae Species Richness and Biomass

4.126 Algal colonization at Black Ledge was restricted to the rock substratum stations, i.e., the 5' and 10' stations of the A, B, and C transects. The rock samples were all large and artificially-cut; naturally occuring rock associated with the ledge structure itself were not present in the sampling area.

4.127 A total of 52 algal species was recorded from the Black Ledge subtidal stations. Species richness did not appear to be correlated with either depth or transect; richness was relatively high throughout the survey area for all replicates and stations. The number of species contained in individual replicates showed moderate variation, and ranged from a minimum of 22 to a maximum of 33; the average number of species contained in each replicate was 27. The number of species recorded for each station showed considerably less variation, ranging from a low of 36 to a high of 38.

4.128 The red algae Chondria tenuissima was the dominant species throughout the survey area; Chondria was the single most dominant taxa in over 50% of the replicates, and was also the only taxa to be recorded as one of the five dominant species for every replicate. A second tier of dominant species comprised the brown alga Giffordia granulosa and the red algae Lomentaria orchandensis and Callithamnion baileyi. All three were among the five dominant species in 70 - 80% of the replicates. In addition, Giffordia was the most dominant species in three of the replicates, while Callithamnion was the dominant species in one replicate. A third tier of dominant species included the brown alga Ectrocarpus siliculosus, the green alga Ulva lactuca, and the red algae Polysiphonia denudata, P. harveyi, and Grinnellia anmericana; all taxa were among the five dominant species in 20 - 30% of the replicates. A fourth tier of dominants comprised the red algae Callithamnion roseum, Ceramium rubrum, Daysa baillouviana, and Cystoclonium purpureum; all species were among the five dominant taxa in 10% of the replicates.

4.129 Dominance patterns were strongly influenced by the dense concentrations of Mytilus occurring at all stations. The benthic macroalgal species Chondrus crispus and Phyllphora spp., which typically dominate the New England subtidal flora (NUSCo., 1979; BECo, 1980), were not able to successfully compete against Mytilus for space. Dominance was instead shown by those epiphytic and emphemerial species which were able to germinate and grow directly upon Mytilus.

4.130 Biomass varied considerably at both the replicate and station level; replicate biomass ranged from 4.3 to 152.1 g/m^2, and station biomass from 19.0 to 90.4 g/m^2. Biomass and depth appeared to be inversely related. Fifty percent of the 5' replicates had biomass in excess of 100 g/m^2, while 100% of the 10' replicates had biomass below 50 g/m^2. In addition, the 5' stations consistently had greater biomass (67.9 - 90.4 g/m^2) than the 10' stations (19.0 - 42.5 g/m^2). Biomass and transect appeared to be unrelated.

4.131 Black Ledge biomass values were low compared to those recorded for corresponding shallow subtidal localities in New England. In studies conducted at Plymouth, Massachusetts, (BECo, 1980), algal biomass typically ranged from 500 - 600 g/m^2, and values as high as 900 g/m^2 were not uncommon. The appreciably lower Black Ledge biomass was due to the scarcity of benthic macroscopic species; the small filamentous and blade-like species which dominated the Black Ledge populations contributed comparatively little to overall station biomass.

Conclusions

4.132 On Black Ledge itself, wind and tidally driven currents and waves create a hydrodynamic regime which limits the fauna to those species adapted to a hard-bottom high-energy habitat. The depth to which this situation occurs at Black Ledge was not precisely determined by the present survey, but would necessarily be between 10' and 20', and the ledge appeared to end abruptly at approximately 15' (MLW).

4.133 The most conspicuous feature of all stations on the ledge was dense and virtually uninterrupted covering of mussels (Mytilus edulis) on all available rock surfaces. The mussel cover was at least one layer thick on most rocks, but occasionally swelled to two and even three layers in thickness. Mussel cover was commonly so complete that the underlying rock surfaces were not visible to divers. All mussels were similar in size (5 - 7cm) and were judged to be approximately one to two years of age.

4.134 The algal population on Black Ledge were characterized by an overall scarcity of benthic macroscopic species (Chondrus crispus, Phyllophora spp., and Laminaria spp.), and an abundance of smaller ephemeral and epiphytic species (Chondria tenuissima, Lomentaria orchadensis. Callithamnion spp., and Giffordia granulosa). The scarcity of benthic macrophytic species reflected on an inability to successfully compete for space against the extensive mussel populations.

4.135 The ephemeral and epiphytic species, in contrast, were not in direct competition for space with the mussels, and their increased numbers resulted from their ability to utilize the mussels themselves as substratum. The algal populations of all stations were also characterized by relatively high species diversity (a function of the large number of epiphytic and ephemeral species) and low biomass (a reflection of the overall lack of benthic macroscopic species).

4.136 The presence of mixed groups of Stage I and II faunal assemblages in the Black Ledge area is a typical pattern of successional mosaics in harbors. Periodic physical disturbance in the area surrounding Black Ledge is apparently sufficient to prevent the establishment of communities with higher successional states. The frequency of disturbance appears to be greater for areas within the 30' isobath than for stations below this depth. However, even the deepest stations sampled exhibited evidence of a history of recurring periodic disturbance of sufficient magnitude to prevent establishment of a Stage II faunal assemblage. This pattern of disturbance may be related to winter storms, although Station 4 indicated more recent scouring in the REMOTS imagery.

V. ENVIRONMENTAL CONSEQUENCES - POTENTIAL ENVIRONMENTAL EFFECTS

5.01 CLINTON HARBOR

Potential Effects

(a) There may be resistance from Park officials towards any dredged material development work at the site. The existing site conditions and scenery would change markedly. If the project was well presented to emphasize how it could augment and expand the Park services and functions, such resistance might be transferred to encouragement.

(b) Simulations of tidal circulation indicate that placement of a DMCF of the sizes considered will tend to restrict flows more toward the eastern portion of the middle harbor and increase peak and maximum velocities in that area. The degree of increase is generally proportional to the size of the DMCF.

(c) There is a potential that wave refraction/diffraction patterns in the middle harbor would be modified by DMCF placement. A postulate - as yet unanalyzed - is that wave energy could be focused more toward the eastern portion of the harbor in a manner similiar to the predicted increase in tidal current velocity. Modification to current patterns and/or wave refraction patterns may effect sediment transport in the outer harbor which could cause adverse impacts to the navigation channel (i.e. shoaling) and mud flats (i.e. erosion) which exist to the east of the channel.

(d) The filling of the proposed disposal area and subsequent marsh creation would delete one entire habitat (sand/mud flats) type from that portion of the harbor.

(e) The resulting change in current flow and other physical aspects of the environment could in turn affect the distribution of the benthos. We can make some gross predictions about the fate of the existing successional series after emplacement of the DMCF. The facility could alter the biological structure of the harbor by shifting the area of severe physical disturbance offshore, as wave and tidal energy will be concentrated on the outer side of the riprap breakwater. These opportunistic assemblages would probably cover a greater area than present after emplacement of the DMCF, because the sands in front of Cedar Island are extremely poor dissipators of wave energy.

(f) In the proposed disposal area at Clinton Harbor, the resident faunal community appears to be normal, well-balanced, and typical of many northeast estuaries with similar sedimentary and hydrographic regimes. Species such as *Tellina agilis* and *Streblospio benedicti*, the most characteristic species at Clinton, are reported from many areas and form the basis of what may be considered the normal muddy-sand community.

5.02 As may be seen from the finfish section of this report, these benthic invertebrates are a valuable food source for the bottom-feeding fishes, primarily winter flounder. Although these and similar invertebrate species are found in many other areas, the removal of this area from the Clinton Harbor system will unquestionably result in a decrease in available food for the resident bottom-feeding fishes. It is important to note in this regard that the boundaries of the proposed disposal area coincide with the boundaries of this particular community and thus, filling of this area would delete one entire habitat type from the harbor. There is, however, nothing to indicate that this area is unique in the sense that the habitat type or any of the resident species are found nowhere else. As noted previously, the area is a common habitat-type inhabited by common species.

(g) The construction of a marsh or container disposal facility could have an aesthetic impact insofar as odor, sight, and noise are concerned. Construction would also cause the temporary degradation of water quality, mainly in terms of increased turbidity, in the immediate construction zone. In addition, there may be some inconvenience to commercial and recreational vessels.

(h) The long-term impact of the depositing of dredged material into the confined disposal facility or facilities would remove approximately 180 acres of subtidal bottom land at Clinton Outer Harbor converting it to salt marsh upland. The rock exterior of any disposal facility, however, would provide good habitat for some fish species and attribute epifaunal invertebrates and algae communities and would be beneficial to the aquatic community.

(i) The Hammonassett Marsh was made a Natural Area Preserve in 1975 by State administrative directive and Cedar Island also may be protected under recent barrier island legislation. The relationship of any proposed action such as a marsh creation disposal facility must be examined in context with this policy or legislation for compliance and/or acceptability.

(j) Pestiferous Insects. Tidal drainage on the existing marsh will not be interrupted by any phase of the project. The study area will always be subject to tidal action and the marsh habitat designed and constructed such to eliminating breeding habitat for mosquitos or biting flies. Transmission of mosquito borne decreases to humans is exceedingly uncommon in Connecticut. There have been no authenticated cases of encephalitis in humans in Connecticut in recent years.

The project plans and operations would be coordinated with the Connecticut State Department of Health to ensure that insect central and existing marsh drainage is maintained without creating any new problems.

Beneficial Effects

5.03 Large areas of salt marshes in Long Island Sound have been eliminated through dredging and filling. The full extent of the impacts associated with the loss of habitat balance (as distinct from the loss of habitat) in estuaries on the East Coast is unknown, though the long-term consequences are potentially severe. Marsh habitat establishment could be used to attempt to restore overall habitat balance within the Long Island Sound estuary. These new salt marshes would be created at the expense of habitats which have been relatively less affected by dredging and filling in the past. However, some of the more productive marsh areas in the United States are former dredge disposal sites. These areas revegetated naturally and point to the probability of a successful marsh establishment project. Monitoring of the prototype marsh establishment will allow evaluation of the benefits and impacts discussed above.

The creation of additional marsh area as proposed could potentially increase the biological habitat value of the harbor. The additional marsh area would also provide more spawning areas for fish populations as well as increase the amount of spatial resources for salt marsh invetebrates, juvenile fish, and birds. The proposed containment of the DMCF by rip-rap construction would also provide a large amount of surface area for the development of hard-substratum communities. This would increase secondary marine production, providing a greater potential food supply for commercial fish stocks in the Clinton Harbor area as well as a suitable habitat for commercially important invertebrate species (e.g., crabs, lobsters, mussels). The construction of the DMCF as proposed and stated by the contract consultants can only enhance the biological value of the area.

5.04 Creation of a marsh in back of the barrier disposal facility at Clinton would greatly enhance fish and wildlife productivity. In addition, the marsh and confined disposal facility, which would eventually be the responsibility of the State, would increase recreational and educational opportunities in the area.

5.05 Pre- and Post-Marsh Establishment Monitoring

5.06 In order to evaluate the beneficial as well as the detrimental aspects of a marsh establishment in Clinton Harbor, several studies will be conducted at the selected site before and after marsh construction.

5.07 The fauna and flora, as well as the water quality, near the selected site will be monitored in order to allow prediction of the effects of future marsh establishment.

5.08 Studies of the benthos, fish, and waterfowl living in and frequenting the marsh site and the adjacent area would be conducted before and after marsh establishment. These studies could include before-and-after comparisons of numbers of species and individuals of each type of fauna at established sampling sites in the area. Furthermore, the food

habitats of some fish and waterfowl species in the project area should be studied to determine if changes occur in the abundance of types of food items eaten.

5.09 The vegetation around the selected site (existing marsh species and eelgrass) should be monitored to indicate potential benefits or damage due to the marsh establishment. The success of transplanted marsh species should also be closely monitored. Primary productivity, natural colonization, and succession of plants on the dredged material must be documented to help insure the success of future marsh establishment projects in Long Island Sound and the New England region.

5.10 Malodor Abatment. Sediments with organic matter also contain by-products of anaerobic bacterial decomposition, such as hydrogen sulfide, sulfur-containing compounds, fatty acids, aldehydes, amines, and other odorous substances. More often than not, odors emitted by a containment disposal area are not perceptible beyond the vicinity of the receiving basin. Under certain weather and wind conditions, however, odors may be detected at distances from dispoal sites. Malodor abatement is, therefore, a matter that must be addressed.

5.11 The most important consideration in dealing with an odor problem is the distance of the site from nearby communities and the direction of prevailing winds, especially during warmer weather. Where practicable, a project should be scheduled for periods when the population is indoors, when atmospheric conditions are favorable for optimal dispersion, or when prevailing breezes blow offshore. When dredging cannot be so controlled, a gas release device can be installed in the dredge line at the point most distant from any affected population. Placement of the discharge end of a slurry line underwater can also further reduce release of malodors.

5.12 Ozonation and aeration are potential methods for reduction of odors. However, these treatments are possible only when sludge is in a slurry, a condition where efficient gas mixing is difficult. Masking with a counteractive agent is sometimes effective but generally results in a change of odor character with little decrease in intensity.

5.13 Once a fill operation is complete, various applications can abate odors. Lime is often used with dewatered sludge. Calcium oxide or other additives can shift the pH beyond the optimal bacterial growth range and thus, decrease gas production. Sealant, such as sand layers, and diffusion barriers, such as wood chips, are other inexpensive alternatives.

5.14 General Effects of Marsh Establishment on Flora and Fauna

5.15 Some organisms will be benefited by a marsh establishment project, while others will be harmed. Benthic fauna and flora, as well as emergent vegetation, will be buried as dredged material is used to raise

the level of a subtidal or intertidal mudflat. The majority of the benthic flora and fauna will be killed, although actively burrowing invertebrates and some rooted macrophytes can withstand burial by several centimenters (cm) of material. Fishes and waterfowl which inhabit the shallow areas of the estuary will lose some feeding and rearing habitat.

5.16 The vast majority of estuarine fauna and flora will benefit from the broader contributions of the marsh to the estuary: food (energy input) and nutrient cycling, absorption of pollutants, stabilization of substrate, and moderation of water and sediment temperature fluctuations.

5.17 Shoreline Alteration - Another impact which cannot be avoided is the alteration of the shoreline configuration. This will have few far reaching hydrological effects, since tidal currents are so weak in this area that altering their flow will probably not greatly change erosion or nutrient flow patterns. Man-made tidal channels are expected to develop naturally in the marsh; if necessary man-made channels will be established to provide adequate flushing. Prior to stabilization by marsh plants, erosion of material from the disposal site will be prevented by the dike.

5.18 Aesthetic Impacts - During the winter consolidation period, and before the *Spartina alterniflora* has begun to flourish, the disposal site may be aesthetically unpleasing to the eye. This is expected to be a short-term effect, as substantial growth should take place in the first growing season.

5.19 Black Ledge

5.20 Potential Effects - In order to attain the one-half square mile area facility proposed the rock breakwater would have to be constructed near the 20' isobath. A rock breakwater of this size and length would provide an extremely large area for the re-establishment of a community similar to that which is presently found on Black Ledge. Assuming a square configuration 1/2-mile on each side, the 20' breakwater would be approixmately 10,500' in length. Allowing for a slope on the outer face of 45°, and an increase in colonizable area of 3X due to the numerous crevices between individual stones, the total new area available would be approximately 900,000 square feet. Approximately 50% of the 7×10^{6} square feet of area which would be occupied by the proposed DMCF is hard bottom which presently supports *Mytilus* populations. Thus, construction of the DMCF would remove approximately 75% of this community type from the existing ecosystem. A partial recovery of the mussel resource could be realized with the availability of hard surface afforded by the dike system.

5.21 The confined disposal island facility at Black Ledge would also result in a permanent loss of approximately 160 acres.

5.22 Changes in tidal calculations and wave patterns with potential adverse erosive impacts to mainland shoreline and/or sediment transplant into present navigation channel.

5.23 Objection of property owners on the basis of aesthetic appearance of facility.

5.24 Beneficial Effects - The Black Ledge site was recommended for consideration by the City of Groton Conservation Commission and Harbor Study Commission. The local interest groups believe the Thames River island facility could possibly serve as a controlled ecological educational studies facility and ultimately be developed as a nature preserve. A container structure at this site would also provide storm protection to the southern shore of the city of Groton. This suggested area is reported to be a "hazard to navigation of recreational boating and of minimum value for fishing and lobstering."

5.25 Impacts Common to All Disposal Containment Plans

5.26 Installation of the dike perimeter to confined disposal facilities would disturb local sediments, generating temporarily increased turbidity levels, and possibly reducing dissolved oxygen levels. Any accidental spillage of oil and construction materials would lower water quality also. These effects are considered short-term.

5.27 Benthic organisms inhabiting any disposal site would be destroyed. Turbidity and reduced dissolved oxygen levels would temporarily disturb fish, phytoplankton, and zooplankton in the construction area. The perimeter dikes would provide extensive rock-faced habitat for establishment of an aquatic community. Construction-generated noise and dust would disturb local wildlife. Wildlife inhabiting any marshlands within or immediately adjacent to the diked facility would be destroyed, displaced, or disturbed. Stagnant ponds could form during facility filling providing conditions favorable for mosquitoes. This hazard could be minimized or eliminated by providing interior drainage patterns to eliminate the establishment of stagnant ponds, or provide for periodic flushing of the facility with new water.

5.28 Construction activities would cause temporary suspension of material with resultant lowering of oxygen levels, resuspension of pollutants and a decrease in light penetration. Resuspension of nutrients such as nitrogen and phosphorus caused by dredging could make these nutrients more available to aquatic plant life. This in turn could increase the productivity and abundance of these plants in the area. Possibility of algal blooms could become greater depending on the specific site location in terms of its confinement to wind and tidal action. Waves and currents could keep a portion of the nutrients in suspension. Aquatic plant life would use up some of these nutrients and some would resettle on the bottom. Resuspension of nutrients is considered a short-term effect of dredging. It should be noted that turbidity in the shallows of LIS is also a natural phenomenon caused by wave action. The shape of the containment facility would act as a wind or wave barrier to allow shallow tidal water to be developed into wetlands. The facility could also provide some erosion protection of the adjacent shorelines.

5.29 Archaeological & Historical Resources

5.30 Clinton - Clinton was an active port in the 18th and 19th centuries, though not a major port of the stature of New London or New Haven. Examination of 19th century charts indicates that harbor development was concentrated in the vicinity of the town landing, while harbor entry was in the approximate location of the present Federal channel. The considerable shallows at the proposed project site would have been fairly well known to vessels using the harbor and avoided in favor of a northerly bearing with Cedar Island as a landmark. A search of numerous documentary sources revealed no recorded shipwrecks at Clinton Harbor.

5.31 Several prehistoric archaeological sites are reported in the Clinton area, including camp sites and burial locations. Most of these recorded sites appear to be on the eastern shore of the harbor, and date from the Archaic Period (ca. 7000 B.C.) and later. Most of the western shore consists of saltmarsh or disturbed ground at Hammonasset Beach, but prehistoric sites could exist on small undisturbed areas of high ground. Geologic borings taken on the project site indicate that it is drowned marsh, similar to the existing marshes to the west, and unsalted for prehistoric occupation prior to submergence.

5.32 New London: New London was one of the major ports of Connecticut throughout the 17th, 18th and early 19th centuries. Most 17th and 18th century trade was coastal and West Indian, while whaling became a major economic venture during the early 19th century. Black Ledge was noted as a major navigation hazard on the eastern approach to the harbor, and a lighthouse was built on Avery Point, north of it, in 1801. This was replaced by the present light in 1909. Both lights are of historic and architectural significance. Known wrecks in the vicinity include the 8 gun privateer sloop "Hermolne" "run on shore at the east" (of the harbor) on Nov. 1, 1982 and the schooner "Ruth," stranded near the light in 1913. Other recorded wrecks of 18th-20th century date may be the vicinity, but their locations are even less clearly indicated in documents.

5.33 Distance from the present shoreline, rocky geologic conditions, and storm action for several thousand years indicate that intact submerged prehistoric sites are very unlikely at Black Ledge.

5.34 Impacts

5.35 Clinton: As submerged prehistoric sites appear unlikely at the proposed containment site, no recorded historic wrecks are known, and the harbor entry always appears to have been considerably east of the site, no effect upon historic or archaeological resources is expected at the Clinton containment site.

5.36 New London: While submerged prehistoric sites are very unlikely at the New London containment site, at least two historic period shipwrecks may have occurred in the immediate vicinity, and locational

factors indicate that unrecorded ones may also be present. Therefore, if this alternative proceeds to further states of study an underwater remote sensing survey may be necessary to locate and identify shipwrecks in the project area.

5.37 Bridgeport Harbor - Filling of the Yellow Mill Channel above the Stratford Avenue Bridge would be unlikely to affect prehistoric or historic archaeological resources, given the modern maintenance of this channel. There are no recorded shipwrecks within the Yellow Mill Channel.

5.38 Milford Harbor - The location of this proposed containment area near the river mouth appears an unlikely location for undisturbed prehistoric resources, and unlikely to contain historic period shipwrecks, given the fairly sheltered nature of the area and light historic period shipping compared to major ports such as New London, Bridgeport, and New Haven. There are no recorded shipwrecks in Milford Harbor.

5.39 New London Harbor-Winthrop Point - Historic period dredging in the area of Winthrop Point makes intact prehistoric resources unlikely in the study area, and renders early shipwrecks equally unlikely. The only known historic period wrecks in this location are two derelict wooden barges, one of which is joined to filled land. These are of early 20th century design, and unlikely to constitute significant historic resources.

5.40 Penfield Shoal - This location was originally a 200 acre island, reduced over the course of the 19th century by its use as a ballast source for sailing vessels. By the 1890's, it had been reduced to a reef. Recorded wrecks on Penfield Shoal include a schooner which foundered in the early 20th century. While intact prehistoric resources are highly unlikely, late 19th century wrecks may be present within the study area. Earlier wrecks are also possible, but less likely given the more conspicuous nature of the shoal when the island was present.

VI. PUBLIC PARTICIPATION

6.01 Public workshop meetings were held in New London, New Haven, and Stamford, Connecticut, and Great Neck, New York, 18-21 May 1981. Immediately prior to the workshops an information brochure was distributed which explained the nature of the study, the issues and problems associated with containment, the unique Long Island Sound ecosystem, the character of dredged material, the site selection criteria and the planning process. The purpose of the workshops was educational: to acquaint the attendees with the concept of dredged material containment facilities (DMCF's), how such facilities work, the environmental issues, and the status of the overall study.

6.02 Each workshop session began with an introduction explaining the intent of the study and the purpose of the workshops. Two Corps representatives - a water resources engineer and a marine biologist - then gave slide presentations explaining the containment concept and how it has been used effectively in coastal and riverine waters throughout the country.

6.03 In addition to the general public, attendees included representatives from the State of Connecticut Department of Environmental Protection including the Coastal Area Management Office, State Waterways Section of the Department of Transportation, State of New York officials, U.S. Fish and Wildlife Service, National Marine Fisheries Service, municipal interests, local businessmen, the media and Congressional aids.

6.04 Subsequent to the workshop meetings a Workshop Digest was prepared by the Long Island Sound Taskforce for the Corps to summarize the issues and questions raised at each meeting.

6.05 A public information news update was also issued in October 1981 which summarized on-going contract studies including a Market User Survey, Socioeconomic studies, prototype environmental baseline studies at Clinton Harbor, Black Ledge, New London and Yellow Mill Channel at Bridgeport, and island/shoal areas screening for potential use as dredged material containment facilities.

6.06 It is the stated policy of the Corps of Engineers to provide opportunity for early public review of all plans and proposals. For the purposes of the Long Island Sound containment study, participation is a three stage process involving:

1. Establishment of lines of communication with affected agencies and non-governmental groups;

2. Circulation of the appropriate Stage I planning documents for public review, and conducting public meetings; and

3. Development of a public involvement program for Stage II with follow-up programs for Stage III meeting - the Draft

Environmental Impact statement is to be circulated prior to Stage III meetings. This program is intended to keep the public informed of the status of planning, to actively solicit citizen opinions and perceptions of the project, and their preference for resource use and various proposed alternatives.

6.07 As a result of the public workshops local support of the study is strong and interest groups have identified several potential viable containment sites. The search for potential containment sites is continuing and suggestions and recommendations from the general public are welcome.

6.08 Coordination of the study is continuing with the Fish and Wildlife Service, National Marine Fisheries, Connecticut Coastal Area Management Office and Department of Environmental Protection as well as local officials and interest groups. A second series of public workshops is anticipated for the spring of 1983 to convey the results and findings of our recent planning studies.

6.09 Questions and comments relevant to this Environmental Report should be directed to Mr. Gib Chase (617-647-8236), Environmental Resources Specialist and Environmental Impact Coordinator, Impact Analysis Branch, New England Division, U.S. Army Corps of Engineers.

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OCT 15 1982

Colonel Carl B. Sciple
Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Sciple:

This planning aid letter is intended to aid your study planning efforts for the Long Island Sound Dredged Material Disposal Container Study, Connecticut and New York. It has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

Mr. Ignazio's letter of July 12, 1982, requested that we conduct a preliminary ecological feasibility analysis of the fourteen (14) sites identified as possible dredge material containment disposal areas. This planning aid letter provides a brief environmental description and an environmental sensitivity ranking of the fourteen sites.

In the majority of cases detailed site development plans concerning the size, method of construction, amount and kind of fill, and potential use have not been identified. As a result, it is inappropriate at this time to determine the site specific environmental impacts of such development. In addition, detailed site specific environmental data are not available for the vast majority of the sites. Therefore, professional judgments and opinions were important in characterizing each site's environmental sensitivities to dredge material container development.

Representatives from the National Marine Fisheries Service, Marine Regional Headquarters and Wildlife Unit of the Connecticut Department of Environmental Protection, Aquaculture Division of the Connecticut Department of Agriculture, and the New York Department of Environmental Conservation contributed their technical expertise and judgment to this Service's evaluation of the fourteen sites. This letter does not represent the official views of those participating agencies concerning the ultimate development of any of these sites for dredge material containment disposal areas. However, it does serve to delineate the evaluated sites into sensitivity groups ranging from the least to the most sensitive from an environmental standpoint.

The following is a brief environmental description of the fourteen sites:

Flushing Bay - This 360-acre site designated for dredged material disposed is a highly stressed area located adjacent to LaGuardia Airport, Long Island, New York. Anaerobic conditions usually occur in this area during the summer

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months and restricts utilization of the area by finfish and shellfish. However, blue fish and other species do utilize this area to some extent and blue crabs are active scavengers of this area during seasons when dissolved oxygen is not a limiting factor.

The Flushing Bay area is considered a critical area for overwintering waterfowl by the New York State Department of Environmental Conservation. Waterfowl that overwinter here are Black ducks, Canada geese, Brant, Red-Breasted mergansers, Mallards and American golden-eye. A large variety of shorebirds and seabirds also utilize the general area of the site. Areas near Flushing Bay, such as North Brother's and South Brother's Island, support nesting colonies of Cattle egrets and Snowy egrets.

An extension from the south edge of LaGuardia, which was recently built, provided conditions for a saltmarsh to grow west of this spit. The area designated for container development is of the same character and could be used to produce a saltmarsh which would be an aid to water quality in the area.

Scotch Caps - This site is located on the east side of Milton Harbor near Mamaroneck, New York. The rock outcroppings, ledges and reef structures associated with this site provide excellent habitat for such organisms as rock weed, blue and ribbed mussels, barnacles, and other benthic invertebrates which contribute to the overall productivity of this area. It is considered to be excellent lobster habitat and does support a commercial fishery. This area also supports a considerable oyster population, especially on the western side.

The entire eastern edge supports an excellent striped bass fishery. Other finfish resources include cunner, winter flounder, tautog, black sea bass and porgy all of which are sought both commercially and recreationally.

Black Tom - This site is located on the western side of Mamaroneck Harbor, Mamaroneck, New York. The rock outcroppings, ledges and reef structures associated with this site are similar, though smaller in area, to Scotch Caps. It is a very productive area and has the same species association as Scotch Caps.

Hen Island - This site is located on the eastern edge of Mamaroneck Harbor, Mamaroneck, New York. Hen Island has a substantial salt marsh around it and is probably one of the best waterfowl and shorebird areas in Mamaroneck Harbor. It is also associated with a reef system and supports both blue and ribbed mussels, oysters, blue crabs and lobsters.

Hen Island is similar to Scotch Caps in that it has the same finfish resources and supports a productive striped bass fishery along its eastern shore.

Harbor Island Park - This site is located at the head of Mamaroneck Harbor and is a fully developed park with tennis courts, town beach, marina, etc. It receives near maximum recreational use and was not considered to be a spoil area. Therefore, this site received no further evaluation.

Sherwood Island: - This site is a barrow hole(s) located offshore of Sherwood's Island State Park in Westport, Connecticut. The preliminary plan is to

fill this hole(s) with Class II or Class III materials and cap it with Class I material. Sherwood Point is the apex of a number of boundary lines marking shellfish lots (oyster and hard clam). While there are no leased shellfish beds within the hole area, it does contain a natural population of hard clams. There are 4 leased shellfish beds and one natural bed shoreward of the hole area and many more leased beds seaward of the area and to the west toward Cedar Point. There is also a significant amount of recreational clamming along the inshore area. This area has been certified as clean water by the State Health Department for the direct marketing of shellfish. Lobsters are found generally seaward of the hole, starting at about the 30-foot contour, and support both a commercial and recreational fishery. The general area supports a fairly strong sport fishery for winter flounder, bluefish, striped bass, scup, blackfish and weakfish. While there is a fairly large population of Canada Geese in the general area their utilization of the immediate hole area is minimal.

This site was evaluated assuming that Class III materials would not be dumped in this productive shellfish area.

Yellow Mill Channel: - This man-made dredged channel is located in the upper reaches of Bridgeport Harbor and extends from Cooks Point to Crescent Avenue. The preliminary plan is to fill this area from about the I-95 overpass to Crescent Avenue and develop a "green" area-recreational park. Environmentally, Yellow Mill Channel is a severely stressed water body and under existing conditions is of low value to fish and wildlife resources. Local residents do fish the area and catch an occasional bluefish, tomcod or other species. Nearly every summer a die-off of menhaden occurs in this area due to poor water quality conditions. The area does receive moderate use by a variety of shorebirds. South of Yellow Mill Channel the water quality is still degraded, however, Bridgeport Harbor does support significant shellfish resources and there are both natural beds and leased grounds in this area. Finfish resources of the harbor area include menhaden, striped bass, Atlantic mackerel, winter and summer flounder, scup, tomcod, and bluefish. The most heavily used sport fishing areas are the Pleasure Beach Jetty and the Seaside Park area.

Pennfield Shoals/Reef - This site is located off of Shoal Point, Fairfield, Connecticut. Preliminary plans envision island creation with diking on four sides. The reef is approximately one-mile long and is one of the few areas along this part of the coast that has a significant amount of rocky-cobble bottom. It is a very productive area from a fish and wildlife standpoint. There is a large natural bed of oysters and hard clams that extends from the reef, east, to well below Pine Creek Point. The reef area also supports a large population of blue mussels. Immediately to the north and west of the reef there are leased shellfish beds. The rocky habitat around Pennfield Light is a productive area for lobsters. Both shore-based and boat fishermen utilize the area. It is considered to be one of the better surf fishing spots in the State of Connecticut. Predominate fish species include striped bass, bluefish, weakfish, winter and summer flounder and Atlantic mackerel. This shoal area is also extensively utilized by waterfowl such as Black ducks and Scaup and provides excellent feeding and resting habitat for a large variety of seabirds and shorebirds.

Milford Harbor - This site is located on the west side of the harbor entrance channel jetty at Milford, Connecticut. The preliminary plan is to create a relatively large rectangular shaped container extending from shore to the end of the jetty. This area is predominantly a large sand flat with a fringe of salt marsh along the shoreline. It does support a few soft-shelled clams and hard clams but it is not considered to be a very productive area. However, there are significant commercial oyster and hard clam grounds in the general vicinity, approximately 1500-feet off-shore. The general area of this proposed site is heavily utilized by a variety of shorebirds and receives moderate use by waterfowl. Sport fishing pressure is heavy, especially off the jetty which has excellent public access. The channel-ward side of the jetty receives the greatest fishing pressure and the predominate fish species caught are bluefish, striped bass, winter flounder, weakfish and tomcod.

Thames River - This site is located under the Gold Star Bridge on the west bank of the Thames River in New London, Connecticut. The preliminary plan for this area is to create a large square shaped container extending from Winthrop Point north under the Gold Star Bridge to the cable area and out to the bascule opening of the railroad bridge, nearly half the width of the Thames River. The container area supports both hard clams and oysters, however, the largest concentration of these shellfish occurs north of the site and are utilized for transplanting purposes. A moderate population of blue crabs also inhabits the container area. Immediately north of the proposed container site a large concentration of winter flounder occurs during the months of January, February and March and while not documented they probably spawn in this area. There is a new State-owned boat launching ramp under the Gold Star Bridge and it is heavily utilized by sport fishermen. The site area also receives heavy use from shore-based fishermen and it is one of the few places on the Thames River that has excellent access for this type of fishing. The predominate fish species caught in this area are winter flounder, bluefish, striped bass, scup, Atlantic mackrel and weakfish. The heaviest concentration of canvasback ducks in Connecticut occurs on the Thames River and they do utilize the site area along with Scaup and Black ducks. A large resident population of Mute swans inhabit the Thames and some of them regularly utilize the proposed container area.

Menunketesuch Island - This site is located east of the Patchogue River between Duck Island Roads and Westbrook Harbor. The preliminary plan consists of unconfined disposal of Class I and Class II materials to restore the northern end of the island and provide nesting habitat for Least terns. This area is open to harvesting of shellfish. There is a 266 acre shellfish bed (oysters, hard clams and surf clams) to the west of the island that is State-owned but has not been leased. To the east there are significant beds of soft-shelled clams, hard clams and oysters. There is a lobster fishery off of Duck Island that extends to the southern tip of Menunketesuch Island. While the immediate area of the site is shallow and sandy it does support a moderate sport fishery for bluefish, winter flounder, striped bass and weakfish. The general area is quite heavily utilized by a variety of seabirds and shorebirds but is not extensively used by waterfowl.

Guilford Harbor - This is an upland site located on the east bank of the West River near the Guilford Marina. The area is diked and has been previously

used for disposal of dredged materials. There are no significant fish and wildlife resources within the immediate disposal area. However, the West River is a very productive oyster area and also has soft-shell clams, blue mussels and blue crabs.

West Haven - This is an upland site located on the west bank of the West River between Interstate I-95 and the Penn Central New Haven Railroad tracks. The 10 1/2 acre site is diked and has been previously used for disposal of dredged material. There are no significant fish and wildlife resources within the immediate disposal area. However, there are leased shellfish beds at the mouth of the West River which are good seed oyster producing areas.

Mouth of Housatonic River - This site is located off of Milford Point behind the breakwater in Milford, Connecticut. We assume that the plan envisioned for this large triangular site is island creation. This area is quite productive from a fish and wildlife standpoint. The breakwater area supports a large population of blue mussels. There are natural beds of hard clams, oysters and soft-shell clams within the area of this proposed container. Directly to the east of the breakwater there are a large number of leased shellfish beds (oyster, hard clam) and the major portion of one of these beds lies within the container area. The mouth of the Housatonic River supports a very active sports fishery especially for such species as bluefish, striped bass and winter flounder. Fishing from the breakwater is severely limited since there is no public access, however, if such access were provided, this breakwater would become a very significant fishing area for shore-based fishermen. The proposed container site and adjacent lands provide excellent habitat for shorebirds. Milford Point is a Least tern nesting area. This point is privately owned and we understand that a portion of it is leased to the Audubon Society. The State-owned Nells Island area is heavily utilized by Black ducks, Mallards, and Canada geese. This general area is also considered to be a major resting area for hawks during the migration period.

The environmental sensitivities of the evaluated sites were rated using a technique from the U.S. Fish and Wildlife Service's Habitat Evaluation Procedures, the calculation of Relative Value Indices (RVI). The calucation of RVI values is performed in three steps: 1) defining the perceived significance of RVI criteria; 2) rating each identified site against each criterion; and 3) transforming the perceived significance of each criterion and each site's rating into a RVI.

The RVI criteria used in this excercise are: 1) fishery resources; 2) wildlife resources, 3) water quality, 4) physical characteristics, and 5) development potential (See Table 1). The first step in RVI calculation involves the application of relative weights to each criterion to numerically define its perceived importance to the user. Pairwise comparisons are made in which each criterion is compared to every other criterion, and a decision is made about which criterion of any pair is more important. Values assigned to all pairs must be equal to 1. These comparisons can be easily made in a simple matrix and the relative weight of each criterion obtained as shown in Table 2.

The second step in RVI calculations involves rating each potential container site against each criterion. This does not involve a partitioning of values between two choices, but rather involves a judgment of what value between 0.1 and 1.0 (from Table 1) is most appropriate for each container site and criterion. These values are shown in Table 3.

Table 1. Relative Value Index Criteria for Evaluated Sites

Criteria	Definition	Range of Value
Fishery Resources	Finfish resources, shellfish resources, benthic organisms, etc.	0.1 low quality 1.0 high quality
Wildlife Resources	Waterfowl, shorebirds, songbirds, mammals, etc.	0.1 low quality 1.0 high quality
Water Quality		0.1 low quality 1.0 high quality
Physical Characteristics	Previous use of the area, amount of fill, upland/intertidal/subtidal area. Natural dynamics should be considered.	0.1 greatly disturbed 1.0 essentially undisturbed
Development Potential	Potential for developing habitat for fish & wildlife resources	0.1 easily managed or created 1.0 little or no possibility to manage or create

Table 2. Pairwise Comparison Matrix for Determining Relative Weights for each Ranking Criterion.[1/]

1. Study

Long Island Sound Dredged Material Disposal Container Study

2. Ranking criteria	**3. Ranking criteria (1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**Dummy**	**4. Sum**	**6. Relative weight**
(1) Fishery Resources	XXXXX	.50	.65	.80	.62		1.0	3.57	0.24
(2) Wildlife Resources	.50	XXXXX	.65	.80	.62		1.0	3.57	0.24
(3) Water Quality	.35	.35	XXXXX	.60	.42		1.0	2.72	0.18
(4) Physical Characteristics	.20	.20	.40	XXXXX	.42		1.0	2.22	0.15
(5) Development Potential	.38	.38	.58	.58	XXXXX		1.0	2.92	0.19
(6)						XXXXX	1.0		
Dummy criterion	0	0	0	0	0	0	XXXXX	0.0	0.00
								5. Total 15.00	**7. Total weight** 1.00

1/ Average values, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Connecticut Department of Environmental Protection, and the Aquaculture Division of the Connecticut Department of Agriculture.

Table 3. Determination of Relative Value Indices for each Evaluation Site.

1. Stucy
Long Island Sound Dredged Material Disposal Container Study

2. Evaluation site	3. Relative weight of ranking criteria 1	2	3	4	5	6	5. Relative value	6. Relati Value Inde
	0.24	0.24	0.18	0.15	0.19			
	4. Relative importance of each ranking criterion to each evaluation species.							
New York[1/]								
Flushing Bay	.30	.90	.27	.40	.50			
Product	.07	.22	.05	.06	.10		.50	.66
Scotch Caps	.80	.50	.70	.90	.87			
Product	.19	.12	.13	.14	.17		.75	.99
Black Tom	.80	.30	.70	1.0	.90			
Product	.19	.07	.13	.15	.17		.71	.93
Hen Island	.70	.67	.70	.73	.83			
Product	.17	.16	.13	.11	.16		.73	.96
Harbor Island Park	Fully developed park, not a disposal site							
Product							---	---
Connecticut[2/]								
Sherwood Island	.88	.30	1.00	.52	.20			
Product	.21	.07	.18	.09	.04		.59	.78
Yellow Mill Channel	.18	.28	.12	.10	.32			
Product	.04	.07	.02	.02	.06		.21	.28
Pennfield Shoals/ Reef	1.00	.72	.72	.72	.60			
Product	.24	.17	.13	.11	.11		.76	1.00

Table 3. Cont.

1. Study

2. Evaluation site	3. Relative weight of ranking criteria						5. Relative value	6. Relati Value Inde·
	1	2	3	4	5	6		
	0.24	0.24	0.18	0.15	0.19			
	4. Relative importance of each ranking criterion to each evaluation species.							
Milford Harbor	.75	.58	.68	.48	.38			
Product	.18	.14	.12	.07	.07		.58	.76
Thames River, Gold Star Bridge	.85	.60	.60	.35	.75			
Product	.20	.14	.11	.05	.14		.64	.84
Menunketesuch Island	.70	.38	.78	.68	.28			
Product	.17	.09	.14	.10	.05		.55	.72
Guilford Harbor	.10	.28	.10	.10	.20			
Product	.02	.07	.02	.02	.04		.17	.22
West Haven	.12	.22	.10	.10	.28			
Product	.03	.05	.02	.02	.05		.17	.22
Mouth Housatonic River	.90	.85	.70	.52	.42			
Product	.22	.20	.13	.08	.08		.71	.93

1/ Average values, National Marine Fisheries Service, U.S. Fish and Wildlife Service and New York Department of Environmental Conservation data as interpreted by USF&WS.

2/ Average values, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Connecticut Department of Environmental Protection, and the Aquaculture Division of the Connecticut Department of Agriculture.

The final step in RVI calculation involves multiplication of the relative weight of each criterion, determined in Step 1, by the value assigned each site in Step 2. All products for a site are then summed to obtain a relative value. This relative value is then divided by the highest relative value obtained for any site to determine each RVI. The relative values and RVI's for the evaluated sites are shown in Table 3. Sites with the lowest RVI's are the least sensitive and those with the highest RVI's are the most sensitive from an environmental standpoint.

In summary, Table 4 lists the evaluated sites and their RVI's in order of increasing environmental sensitivity. This list is broken into three groups representing the least environmentally sensitive (Group I), moderate environmentally sensitivity (Group II), and most environmentally sensitive (Group III).

Table 4. Environmental Sensitivity of Sites to Dredged Material Disposal Containment Development.

Site	RVI	
Guilford Harbor	.22	Group I
West Haven	.22	Least Sensitive
Yellow Mill Channel	.28	
Flushing Bay	.66	
Menunketesuch Island	.72	Group II
Milford Harbor	.76	Moderately
Sherwood Island	.78	Sensitive
Thames River, Gold Star Bridge	.84	
Mouth of Housatonic River	.93	Group III
Black Tom	.93	Most
Hen Island	.96	Sensitive
Scotch Caps	.99	
Pennfield Shoals/Reef	1.00	

We are very much concerned with finding improved disposal procedures since existing practices usually result in adverse impacts on fish and wildlife resources. Our support and interest in your study is based on the belief that dredge material can and should be used to benefit the natural environment and we plan to continue our coordination during further planning.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor

LONG ISLAND SOUND
DREDGED MATERIAL CONTAINMENT STUDY

SOCIAL CONSIDERATIONS

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SOCIAL CONSIDERATIONS

INTRODUCTION

This section analyzes the acceptability and possible social impacts associated with the construction and operation of dredged material containment facilities at six locations along the Connecticut shoreline of Long Island Sound. Short term impacts occurring during construction of dikes, filling with dredged material, dewatering, final capping, contouring and planting have been examined along with long term effects involved in the ultimate use of the site. This analysis has identified social effects in both the primary and secondary impact areas, which are the regions within a 1-mile and 5-mile radius, respectively. The analysis is based on research of existing literature about containment studies, site visits, four public workshops and personal interviews.

OVERVIEW

The Long Island Sound region consists of Connecticut, with its four coastal and four inland counties, and the New York City area, encompassing the five counties that are the boroughs of New York City as well as Nassau and Suffolk Counties on Long Island. Westchester County, which links New York City with southwestern Connecticut, also is part of the study area.

Population

This 16-county region has a 1980 population of almost 13.7 million and an average population density of 2,000 people per square mile. Between 1970 and 1980 the United States grew in population by 11.5 percent, while the number of residents in the study area decreased by 3.1 percent. A modest growth in Connecticut was overwhelmed by losses of 802,000 people in the New York area; and Connecticut's 2.5 percent increase was down sharply from growth rates of 20 percent in the 1960's and 26 percent in the 1950's. Population levels in the Long Island Sound region have been directly related to the cost of energy. Crowding, the overall costs of living, and the decline in employment in manufacturing, trade and other activities caused in part by the three national recessions, have all contributed to the population losses. The New York City area, however, added 167,000 housing units (9 percent), mostly on Long Island, over the last decade; and Connecticut added 177,000 (18 percent) dwelling units.

Economy

In contrast to the population trends in the Long Island Sound region, nonagricultural employment grew by 19 percent in Connecticut and dropped only 4.4 percent in the New York City area. This gives the overall region a 2.6 percent increase between 1970 and 1980. As Table 1 shows, the only

major employment sector in the New York area to show significant growth during the 1970's was services. This sector was also the fastest growing in Connecticut, followed by finance/insurance/real estate and by trade. Construction suffered the greatest employment losses in the region. Government employment in the New York area remained essentially constant, though overall population and employment declined regionwide. Government employment totaled 910,000 in 1970 and 923,000 in 1980, but shifts did occur. Federal employment dropped 11 percent and local government decreased by about one percent. These declines were balanced by a 28 percent increase in state government employment.

Projections

Three population growth scenarios, ranging from pessimistic to modestly optimistic, were developed for the 50-year period of 1985-2035.* Estimates for 2035 vary from 12.6 million to 17.4 million, with a more probable range of 14.3 million to 16.0 million. This probable range represents a relatively small growth considering the 1980 level of 13.7 million. Which growth pattern this densely inhabitated region may follow in the future cannot be stated with any degree of certainty at this time. Even under the most pessimistic but realistic scenario, it appears unlikely that the 16-county region around Long Island Sound will have a lower net population in 2035 than it does today. Conversely, even under relatively optimistic growth conditions, it does not appear that the region is likely to grow more than an average of 3 percent per decade, which would lead to a regional population of about 15.5 million in 2035, or an overall increase of about 14 percent--a growth consistently much less than the remainder of the Nation during the foreseeable future. The availability and cost of energy in the Northeast, compared to the rest of the United States, is considered to be the prime determinant of future growth in the Long Island Sound region.

IMPACTS

A list of social impact assessment attributes was developed from literature review, review of Corps permit applications, communication with persons knowledgeable of DMCF's, and the Water Resources Council's Principles and Standards.

Before identifying the assessment categories, a distinction between the temporal and spatial scopes within which the attributes are assessed should be made. The temporal distinction is short term and long term impacts. Short term impacts apply to DMCF activities during the construction and filling period; long term impacts relate to the eventual DMCF site use projected to be established. Spatial distinction is made between the primary impact area and the secondary impact area for each

*Projections were developed for New England Division by The Center for the Environment & Man, Inc., of Hartford, Connecticut.

TABLE 1

LONG ISLAND SOUND REGION

EMPLOYMENT BY SECTOR
(Numbers rounded to nearest thousands)

New York City Area	1970	1980	% Change
Construction	172,000	127,000	-26
Manufacturing	943,000	743,000	-21
Transportation/Communications/ Utilities	375,000	315,000	-16
Trade	995,000	927,000	- 7
Finance/Insurance/Real Estate	505,000	516,000	+ 2
Service	992,000	1,180,000	+20
Government	752,000	740,000	- 2
Connecticut			
Construction	57,000	49,000	-14
Manufacturing	422,000	422,000	0
Transportation/Communications/ Utilities	54,000	61,000	+13
Trade	225,000	299,000	+33
Finance/Insurance/Real Estate	74,000	105,000	+42
Service	184,000	286,000	+55
Government	158,000	183,000	+16

Source: "Social & Economic Impacts of Selected Potential Dredged Material Containment Facilities in Long Island Sound", report by The Center for the Environment & Man, Inc., September 1981.

DMCF. The primary impact area for this study is the area within a 1-mile radius of the DMCF. Conditions directly affected in the immediate locale may be aesthetics, land uses, land values, recreational opportunities. The secondary impact area is defined as the area between a 1 and 5-mile radius of the DMCF although any regional impact should be included. Impacts likely to be felt in the secondary impact area include changes in income distribution, commercial and industrial activity, regional employment, transportation, and quality of life changes.

Five impact categories with a total of 20 attributes were selected for use in this study.

1. Life, Health and Safety

Boating Hazards - Construction activity can block or congest navigation ways, increasing the risk of accidents. On the other hand, building a dredged material containment facility (DMCF) on shallow, rocky shoals can reduce risk of accidents by making the hazard easier to identify.

Construction Hazards - Risks to construction workers on the DMCF island sites are somewhat higher than on the land-linked sites. Hazards to passersby are greater in highly populated areas through which access to the site is gained.

Final Use Hazards - Over the long term, DMCF created land can become an "attractive hazard" to children or could be used for heavy industry, which has a greater potential for accidents than would a use such as passive recreation.

Traffic Congestion - Development of a DMCF can increase traffic on area roads and may be viewed particularly adverse when hauling trucks travel neighborhood streets. Final use activities may also generate traffic increases.

Vectors - Vectors are organisms that can carry and transmit disease. In the Long Island Sound region, vectors of concern include Norway rats, mosquitoes and other flying insects. Ponding of water during dewatering of deposited sediment creates an environment conducive to mosquito breeding, which would have to be controlled.

Air Pollution - The severity of this impact is related to a site's size, and its proximity to inhabited areas. Dewatered dredged material, blown off the site by winds, can adversely affect air quality. Exhaust of heavy construction equipment can also degrade air quality.

2. Community Organizations

Displacement of People and Activities - Local residents can be displaced from their homes over the short term -- during road

construction, or permanently--with the ultimate use. Commercial marine species, such as shellfish, at the site of a dredged material containment area can be destroyed, causing a loss of revenue and employment.

Zoning Compatibility - *Ultimate land use planned for a DMCF* may not be in agreement with adjacent land use classifications. Related issues are whether the proposed land use is public or private and whether it would be water dependent.

Accessibility - The degree of accessibility should compliment the ultimate usage, e.g., wildlife habitat or housing. Accessibility, or lack, of can pose problems during construction activities as well.

Community Services - This attribute involves the supplying of community services such as police, firemen, educators. Some local services assistance may be required during construction. Over the long term, a local government commitment to DMCF maintenance and security may be required.

Perceived Need - Final use of a facility can help satisfy local needs. For instance, a community with inadequate public waterfront access might assign a high priority to a new park.

3. Financial

Land Value - A dredged *material containment facility* and its ultimate use can have a positive or negative effect on the market value of surrounding land parcels.

Employment - Increases in employment may be significant during construction, but as with other projects, some of the workers may come long distances. Alleviation of local employment needs, however, promote favorable community reaction to a DMCF.

4. Educational and Recreational

Recreational Opportunities - Interruptions of recreational opportunities during construction are temporary, but can result in loss of boat mooring space or restrictions on beach access. Over the long term, DMCF created land can alleviate an existing recreational deficiency, either by expanding existing facilities or creating new recreation areas where none were before.

Educational Opportunities - A community-oriented, recreational-educational facility can be viewed as a community asset.

5. Aesthetics

Noise - This impact, both short and long term, is assessed by considering both the probable differences in noise levels with and without a project and the distance to potentially affected persons.

Odors - Exposure of organically rich material to the air can result in offensive odors during and temporarily after its placement. Many temporary odor problems may be caused by the liberation of gases during pumping operations, however, they can be controlled. Assessment of the potential severity of a project's odors is based on several factors, including sediment character; DMCF design, e.g., new marsh, operating schedule, e.g., one time or periodic disposal; and proximity to populated areas.

Visual Exposure - The greater the number of individuals who live and work within line-of-sight of a project, the greater the impact. Whether it is beneficial or adverse depends somewhat on mitigations during construction, but varies widely with the finished design and ultimate use of the site.

Visual Compatibility - Even if zoning requirements are met, the final use may be socially inappropriate to the adjacent areas's character. Examples are new, low rent housing near private beach clubs, a new marsh near certain industries, or a tall new building adjacent to very short structures.

Reduction of Panoramic View - Final use of site by large structures can reduce the panoramic view. Although reduced, thoughtful design can greatly diminish this impact.

PROPOSED DREDGED MATERIAL CONTAINMENT FACILITIES

Fayerweather Island/Black Rock Harbor

Project

This site is located in Bridgeport between Bridgeport Harbor and Black Rock Harbor, about 50 miles northeast of New York City. The 52-acre containment facility would lengthen Fayerweather Island, which is actually a 1.25-mile-long peninsula. A 3,800-foot-long dike would be 15 feet above mean low water, comparable to the seawall now connecting the island to mainland. The 1.4 million cubic yard containment facility could probably be filled within 2 years. When filled, the average surface elevation of the facility would be comparable to most of the island. Within 5 years of completion, grass and low trees would cover the site. Habitat would be varied; and the final surface would be smoothly contoured for aesthetic appeal, appearing to be a natural coastal wild area ideally suited for passive recreation such as bird watching.

Area Characteristics

Bridgeport's 1980 population of 142,500 residents makes it Connecticut's most populous city. The population density is 8,412 people per square mile. Mean per capita income in 1975 was about $1,000 below the state average. Important industries are manufacturing, trade and port-related activities. The two harbors, Bridgeport and Black Rock handled about 3.2 million tons (one-sixth) of Connecticut's waterborne commerce in 197[illegible] Of this total, 81 percent was petroleum products.

In general, a large volume of boat traffic exists in Black Rock Harbor. Eight commercial piers, wharves and docks are located in the Cedar Creek extension of the harbor. Overall, more than 1,000 slips are available within both harbor areas. It is estimated that more than half of these slips are in Black Rock Harbor. Both powerboats and sailboats are accommodated at the five marinas located on the mainland shore of Black Rock Harbor and Burr and Cedar Creeks.

Approximately 5,200 persons live within a 1-mile radius of the proposed site. A large number of people also work in the area. Fayerweather Island is adjacent to the city's sanitary landfill and is close to Seaside Park, one of the best kept and most popular parks in the city. Across the harbor on the western shore, the area is zoned primarily residential. Numerous homes, several apartment and condominium complexes, and the Black Rock Yacht Club are located there. Industrial lands are farther inland. On the northern shore at Cedar Creek are the Fayerweather Yacht Club, a marina, boat yard and the Port 5 Veterans Association. The city operates a wastewater treatment plant that discharges into Cedar Creek. A large, low-income housing complex is located in the area, as well as a lighthouse at the south end.

Impacts

The most significant short term impacts are judged to be disruption of an existing oyster bed and boating and construction hazards. The most important long term effects are considerd to be the loss of some mooring space and loss of the oyster bed. Within the primary impact area, a 1-mile radius, moderate or large impacts would occur in 10 of 20 possible attributes during the short term construction and filling of the project.

Specific short terms impacts for the primary impact area are as follows.

Impacts under the category of life, health, and safety are expected to be moderate. Boating hazards would exist, due principally to the floating pipeline used during dredging and the normally heavy boat traffic in the harbor. Construction hazards would also exist because the project site is adjacent to Seaside Park which is intensely utilized. Because between 2,300 and 2,600 truckloads of dike material would be required,

moderate traffic congestion would result from trucking of dike material. With a spring schedule of approximately 60 working days over 3 months, trucks would arrive and depart at a rate of one every 7-15 minutes throughout the 10-hour working day. Vectors and particulates may be sources of small to moderate impacts for the area. The existing vector problem is not serious and the acreage addition is not large. Again, because the acreage is small, particulates may only cause a problem during dewatering.

Under the community organization category, construction activities may have a large impact on new oyster beds presently set on the proposed site. This impact is one that will require further investigation as the study progresses. In addition, some boat mooring areas of high demand in the Bridgeport area may be disturbed.

Disruption to recreational and education opportunities are expected to be small, but part of Seaside Park may be closed during construction. Recreational boating may be curtailed as well.

Moderate impacts are also anticipated under the aesthetics category. Because of the presence of residences within the impact area, noise would have an effect. Odors would prevail during the spring and fall disposal operations. However, most of the time, the material would be under water, and eventually capped. The Bridgeport assistant town planner states that approximately 2,300 people across the harbor can see the site, along with visitors to parts of Seaside Park. Thus, short term activities would impact the visual exposure within the primary impact area.

Negligible impacts would be felt in the secondary impact area with the exception of potential boating hazards. The presence of a pipeline and the movement of barges would be a hazard beyond the 1-mile radius and within the 5-mile radius.

Over the long term, with ultimate use of the filled facility, two attributes would be moderately impacted in the primary impact area. Displacement of fishermen because of lost oyster beds would occur. With the loss of some boat mooring space, there would reduction in recreational opportunity. No moderate or large impacts would occur in the secondary impact area over the long term.

<u>Yellow Mill Channel/Bridgeport Harbor</u>

<u>Project</u>

This site, also in Bridgeport Harbor, was studied separately from Black Rock Harbor, possibly just described. The 16.5-acre facility would fill in the upper end of Yellow Mill Channel within 1-2 years with material dredged from Bridgeport Harbor. A 500-foot long dike would rise 20 feet above mean low water. After filling of the 136,000 cubic yard facility, the final elevation would be roughly comparable to the banks of

Yellow Mill Channel. The surface would be suitable for a recreation area after capping with clean sand and topsoil. The space could include softball fields and similar facilities, to be used by local residents. The top of the dike could be capped with a hard-surface path suitable for jogging and cycling.

Area Characteristics

A total of 21 piers, wharves and docks are located in the inner section of the Main Harbor and along Yellow Mill Channel and the Pequonnock and Johnsons Rivers. On the whole, little land is available for development along the waterfront. Though much of the land is under utilized, it is committed to existing users, mostly for industrial purposes. Eight marinas, yacht clubs and boatyards, accommodating both powerboats and sailboats, are located within Bridgeport Harbor. There are long waiting lists for wet storage spaces.

About 31,000 people live within a 1-mile radius of the channel, and there is a mix of residences, light industry and business. Nineteen schools, the Town Hall, police station, library, Federal Court House and hospitals are within a mile of the site. A densely populated housing project is nearby, and unemployment in the immediate area is 25 percent.

Impacts

The most important social impacts of a dredged material containment project in Yellow Mill Channel would possibly be the conversion of two commercial dock facilities to non-marine activities. Furthermore, the high density population adjacent to the channel would bear impacts such as construction hazards, noise and odors. On the other hand, its ultimate use for recreational space would greatly benefit this crowded area, and the filling in would reduce or eliminate an eyesore and a breeding ground for rats.

Of the 20 possible impacts attributes identified in this analysis, five would be moderate to large over the short term.

Construction hazards would be moderate due to the high density residential area adjacent to the site. This proximity would necessitate installation of a fence. Easy access to the site would also provide a hazard because of possible attraction of the construction activities to children.

Aesthetics would be particularly impacted during the construction phase. Noise would be moderate in both the primary and secondary impact zones. Odors may be offensive at times. As indicated, the adjacent area is thickly settled and the dredged material is expected to be highly organic. Visual exposure would be disrupted since the site is visible to the nearby housing project residents and from a roadway at the northeast end.

Over the long term, ultimate use phase, a dozen moderate or large effects, mostly beneficial, can be expected. Habitat for vectors living in Yellow Mill Channel would be reduced. Impact on Jacob Brothers and D'Addario Sand & Gravel may be significant. These two businesses may lose dock facilities; other than barge transport would pose problems for them. Accessibility of the DMCF site is very good and therefore, final use (recreation) can be readily enjoyed. A new park has been indicated as a serious need within this part of Bridgeport; the project can satisfy this need.

Over the long term, ultimate use would also be beneficial to the area's aesthetics. The park would benefit visual exposure; it can be viewed from all angles. A recreational facility is compatible with the existing zoning and panoramic view would be enhanced with the park.

Morris Cove/New Haven Harbor

Project

Morris Cove, which contains the borrow pit site, is located in southeastern New Haven Harbor. The existing borrow pit in Morris Cove has a capacity of about 900,000 cubic yards. Its dimensions are approximately 2,400 by 600 by 25 feet. When completely filled the surface of the containment facility would be about 10 feet below mean low water, essentially the same as the surrounding bottom area. This means none of the dredged material would be exposed to view or air. The upper 2 feet would be clean material, making the 33-acre site suitable for shellfish. The facility could be filled entirely with New Haven Harbor material within 1-2 years, or two to four working seasons (spring and fall).

Area Characteristics

New Haven Harbor is located in the south-central Connecticut region, which includes 36 cities and towns, the largest being New Haven. According to the 1980 census, the New Haven area had a population of 416,542, about 13.5 percent of the state total. New Haven has long been considered industrial, but the number of manufacturing companies in the area has stabilized with more and more professional firms making their way into the city and nearby communities. Of the 14 New Haven labor market area towns, only New Haven is classified as having a labor surplus. In the last 2 years business and community leaders have succeeded in expanding employment with industrial reuse projects.

New Haven Harbor handled half of Connecticut's waterborne commerce in 1979. Almost 90 percent of this was petroleum products. Forty-two piers, wharves and docks line the harbor. Thirty-eight are located in New Haven, and four are in West Haven. Recreational boating is secondary to commercial/industrial activities; and a dozen marinas and yacht clubs line the harbor. Including the yacht club anchorages, there are more than 1,000 slips and moorings in about 43 acres. The irregular coastline

provides many good beaches and sheltered coves for recreational activities such as fishing, swimming and water skiing.

Primarily residential and park lands exist within a 1-mile radius of the borrow pit site. The southern half of East Shore Park is within 1 mile to the north. The section of Brightview in New Haven including the Nathan Hale School lies to the northeast, and further to the east, adjacent to Morris Cove, is Tweed-New Haven Airport. The Morris Cove section of New Haven is southeast of the containment facility location. Lighthouse Point Park and Lighthouse Point are found to the south of the proposed facility. Shellfish are located near the perimeter of the borrow pit site.

Impacts.

Filling of the abandoned underwater borrow pit is considered to have minimal adverse social impacts. Location of the disposal site away from shore and under water averts unpleasant social effects such as odors, partially obstructed views and noise. The floating pipeline may present a minor hazard to which commerical and recreational craft would be exposed. Over the long term, filling of the pit may be beneficial as additional habitat for commercial shellfish.

Of the 20 attributes used in this analysis, none is expected to suffer moderate or large adverse impacts in the event a dredged material containment facility is developed in Morris Cove. A moderate displacement benefit is possible for the primary impact area since the filled pit could be used for shellfish habitat.

Clinton Harbor

Project

A potential DMCF in Clinton Harbor, could accommodate 1,000,000 cubic yards, however, 700,000 cubic yards is a more likely capacity. The smaller one would cover an area of 100 acres; this site would satisfy the dredged material disposal requirements of the harbor for 25 years.

Because the ultimate use of the facility is expansion of local marshes, a low dike would be constructed, using 65,000 cubic yards of material trucked in from local quarry sources. The dike would be faced with 2 feet of riprap for erosion control. Within 2 years of filling, the dike would be covered with marsh grass similar to that in adjacent wetlands. The gently sloping dike would be constructed in -3 feet MLW and would rise to about 6 feet MLW.

Construction of the dike would be completed within a year, with limited work taking place between June and September. Dredging would take place approximately 10 hours a day, 5 days a week.

Area Characteristics

Clinton is situated on the central Connecticut shoreline between Madison and Westbrook. The town encompasses 16.3 square miles; and in 1980 was home to 11,195 people, for a population density of 687.1 persons per square mile. During the past 20 years Clinton has been transformed from a rural to a seasonal, suburban community. Over the next 20 years its desirable environment, reasonable commuting distance to New Haven, and expanding employment base should continue to create a need for additional housing. About 65 percent of the resident workforce is employed outside of town.

Recreational boating dominates habor activities. The eight marinas there have a combined capacity of about 870 slips. Town commerce depends heavily on summertime, water-based recreation. No major industrial users are located along the harbor. Principal industries are fishing and small-boat building. Some commercial fishing takes place out of the harbor, and the largest vessel is about 45 feet long.

Approximately 2,800 people reside within a 1-mile radius of the site. This primary impact area is predominantly Hammonasset Beach State Park wetlands, with village residential, marine business, and town-owned lands also present. Attendance at this state park totalled 932,841 during the 1979 season.

Impacts.

Creating new marsh is considered a net benefit to the area, because it would protect the existing marsh and add wildlife habitat. Because the site is relatively distant from residential areas, unpleasant effects such as odors and noise would be small. Additional marsh will expand insect breeding grounds, which should be controlled.

For the long term there is some concern that the marsh would add to existing vector problems; mitigation measures should be investigated. The perceived community need to remedy the effects of past marsh filling and protect existing marsh from erosion would be somewhat satisfied with construction of a DMCF. These effects are expected to be felt beyond the primary impact area.

Twotree Island/Waterford

Project

Twotree Island is a largely submerged ridge and is considered a navigation hazard. It is essentially a rock outcropping with no vegetation cover, located .9 miles off Millstone Point. The 80-acre containment facility would provide capacity for 3.4 million cubic yards of material to be dredged from New London Harbor and other eastern Long Island Sound ports. The facility would have a dike almost 7000 feet long

and 20 feet above mean low water. This structure would enclose the island, now about 150-200 feet long and 30-50 feet wide. The dike would have a free-form shape to simulate the "natural" contours of an island. An interior, 1,500-foot dike would divide the facility in half. About 810,000 cubic yards of suitable material would be required for construction, which would last from a March to November 9-month working period of nearly 200 working days, 5 days a week. Filling would take 15 to 30 years.

Ultimate use of this site, which is being considered at the request of local conservationists, would be bird and wildlife habitat. It would be capped with 2 feet of clean material, and the surface would be contoured to vary in final elevations up to 10 feet to provide diversity in the habitat. Drainage to minimize insect breeding would be provided. Grass and low trees would be planted. At a distance of a half-mile, the newly raised island would appear aesthetically similar to the numerous rocky islands along the Connecticut shore.

Area Characteristics

Waterford is situated on the eastern Long Island Sound shoreline between East Lyme and New London. No marine facilities are located along the shore; and little recreational boating takes place between the shore and Twotree Island, though it is heavy in the larger area. No dredged channel exists, but a natural one, Twotree Channel, passes to the north between the island and the mainland. The channel's minimum depth is 28 feet, and it is used for construction and maintenance of power stations at Millstone Point. Water-oriented activities are mainly carried out at Pleasure Beach, across open water from the island. In 1978, about 35,000 used this quasi-public recreational beach.

Waterford covers 34.4 square miles and had 17,843 residents in 1980, for a population density of 520 persons per square mile. Mean per capita income in 1975 was slightly below the state average. Northeast Utilities, which owns and operates two nuclear power stations at Millstone Point with a third under construction, is the largest taxpayer in Waterford. Approximately 10 manufacturing companies are in operation in the town. Total manufacturing and nonagricultural employment in June 1977 was 4,010.

In the primary impact area are Pleasure Beach and the State Sanitorium at Millstone Point. Most of the land within the 1-mile radius, however, is residential.

Impacts

The area most affected by a containment facility would probably be Millstone Point, where the currents are used to mix the sound's cooler water with heated water released by the power plants. In addition, accidental releases of sediments could pose problems for local water intake structures. Some local concern has also surfaced regarding 100-

year flood levels and the effects of siltation on the power plants if a containment facility is built. Major adverse impacts involve the view and short term traffic congestion and boating hazards. Displacement of scallop beds is unavoidable, but localized. Major long term benefits are new bird and wildlife habitat and reduced boating hazards. Major benefits attributed to a facility are expanded wildlife habitat and ultimate reduction in boating hazards.

Of the 20 attributes used in this analysis, seven would be moderately impacted in the short term.

The two categories most-impacted over the short term would be life, health, and safety and aesthetics. Boating hazards would increase because recreational use near the site is heavy in the summer. Construction hazards would increase in both the primary and secondary impact areas because of the large volume of dike fill to be transported and deposited at the site. The site, itself, is accessible only to boaters. Traffic congestion would be worsened in the 5-mile radius, if trucks rather than rail are used. Depending on truck capacity, 16-20 loads per hour would be delivered on nearly 200 working days.

Over the short term visual exposure and panoramic view would be disturbed. Noise in the primary impact area would be moderate during the daylight hours. Interference of project activites with recreational boating could affect recreational opportunities.

Over the long term, favorable and unfavorable impacts of moderate degree would be felt in four attributes. Boating hazards would be reduced because the filled site would help boaters locate submerged rocks in the area. The perceived need of the local conservation group for additional bird and wildlife habitat would be somewhat satisfied.

The site's less than complete compatibility with the nearby island would somewhat alter the area's character. Once filled, the facility would have some effect on both the visual exposure and panoramic view of some people within a 1-mile radius.

Black Ledge/New London Harbor

Project

This site is a series of submerged rock prominences to the east of the mouth of the New London Harbor navigation channel. It is 0.3 miles from Avery Point, off the Groton shoreline, which is about 13 miles from the Rhode Island border. Groton is situated on the Thames River.

The 190-acre facility would be divided into three 63-acre cells and enclosed by a dike 20 feet above mean low water. At its nearest point, the facility would be 1,800 feet from Avery Point and 3,300 feet from Shennecossett Beach. The manmade island's perimeter would be approxi-

mately 12,000 feet, and could accommodate 11 million cubic yards of material to be dredged from New London Harbor and other Long Island Sound ports. Nearly 1.2 million cubic yards of suitable material from inland borrow pits would be needed for dike construction, which would take nearly 200 working days (March through November), based on a 5-day work week. Filling the three containment cells would take 30 years or more.

This site was considered at the suggestion of local conservationists. When filled, the facility would provide bird and wildlife habitat. It would appear similar to nearby Pine Island and Bushy Point Island, which are vegetated and somewhat higher than 20 feet above mean low water. As each cell is filled, its surface would be gently contoured, with varying elevations up to 10 feet, and planted in grass and low trees.

Area Characteristics

The city of Groton encompasses 2.8 square miles, and in 1980 was home to 10,090 people. The population density is about 3,300 persons per square mile. The two largest taxpayers are General Dynamics Corporation and Pfizer, Inc. Together, they pay 62.6 percent of the tax revenues collected and employ about 22,000 people. The city streets bear a high volume of commuter traffic.

Seven major industries are near the harbor and receive commodities from piers, wharves and docks. Other industries receive goods via transfer from seagoing vessels to barges at New London. Two companies use the harbor for entry to up-river points. The U.S. Coast Guard has moorings in the harbor, and the U.S. Navy has an anchorage there. About a dozen marinas are within the harbor and have more than 800 slips and 50 moorings. The harbor is used by charter boats, pleasure craft and sailboats for swimming, fishing and water skiing. East Point Beach in Groton and Ocean Beach in New London are town-owned. Osprey Beach in New London is a private beach association facility.

About 880 persons live within a 1-mile radius of the site. Residential land use predominates. Avery Point, the southern end of Pine Island, and Eastern Point are in the primary impact area. Also, within a mile of the site are Shennecossett Yacht Club, Spicer's Marina and a state-owned public launching ramp.

Impacts

The largest impacts of a dredged material containment facility at Black Ledge would involve construction and boating hazards, traffic congestion, displacement of lobsters and clams, reduction of the panoramic view from shore, and creation of wildlife habitat.

Nine of the 20 attributes would be affected to a moderate or large degree over the short term.

Boating hazards would be largely increased because heavy recreational traffic and the Block Island Ferry use the area that would be filled in by the western cell. These vessels would be forced into the main channel. Traffic congestion would be largely impacted in the primary area and moderately affected in the secondary zone only if dike material is trucked to the barge dock rather than carried by rail. Depending on truck capacities, the 6,000 cubic yards of dike material moved to a barge-loading facility each working day would require 20-30 trips per hour.

According to the U.S. Coast Guard, about 10 persons use the area for personal or commercial lobstering. Moderately decreased recreational opportunities may result as construction filling activities interfere with boating.

Noise would be moderate within the immediate impact area, assuming no construction work is done at night. Visual exposure would be moderately affected from beaches, beach clubs, and homes on hillsides. Large machinery would be obtrusive, especially from Eastern Point to Avery Point, and would not be visually compatible with surroundings. Panoramic view impacts would be large in the immediate area and moderate beyond 1-mile, though the dike, which would be 20 feet above mean low water, would be similar in height to adjacent natural islands.

Over the long term, after the facility is filled, benefits and disadvantages would result with 7 of the 20 attributes.

Boating hazards would be increased. Final use hazards would prevail, due to the high dike with large riprap surface. It would be somewhat risky for visitors.

The perceived need of local conservation groups for more wildlife habitat would be somewhat satisfied. The DMCF would proivde the educational opportunities to study island habitat development.

Visual exposure from several beaches would be somewhat affected, as would the panoramic view from Avery Point. The facility's compatibility with the area's character would be largely affected by a 190-acre manmade island.

ANALYSIS OF PERMITS

The Army Corps of Engineers, New England Division, in 1979 and 1980 issued 187 permits for all types of activities at 55 locations in Connecticut. Forty-nine (26 percent) of these permits were for dredging/disposal operations at 23 locations. As Table 2 shows, the amount of material to be dredged in Connecticut during those 2 years totaled 2,412,220 cubic yards. Groton, Shelton and Clinton had the greatest activity.

Objections to the applications were divided almost equally between government agencies and the general public. Most of the dredging/disposal applications (27) elicited no objections, and all but two of the 49 permits included special conditions imposed by New England Division. The amount of material to be dredged seems to have little relationship to whether a dredging permit application will or will not receive objections. Some, but not all, large projects elicited no formal objections, while two small projects received several from agencies and the public.

Tables 3 and 4 list the types of objections lodged against the applications. The principal concerns of both reviewing agencies and the general public were protection of intertidal wetlands and opposition to open water disposal in Long Island Sound. This suggests the dredged material containment facilities may be responsive to a regional need.

SUMMARY

Two of the six sites studied are substantially larger than the others. As can be seen in Table 5, the Twotree Island and Black Ledge facilities would involve considerable dike construction. This would entail land and water movement of large volumes of suitable dike material from inland borrow pits, causing greater boating and construction hazards, traffic congestion, noise and partial obstruction of the view from the shore. Not only are they larger, but both would be built over rocky outcropping in open water close to shore rather than along a coastline or within a harbor. Shellfish would be displaced by both.

On the other hand, these two facilities could accommodate huge quantities of all types of dredged material more safely than would open water disposal. The other alternative is land disposal, but these sites are increasingly difficult to obtain. Either containment facility would meet the disposal needs of northeastern Long Island Sound for 15-30 years or more, avoiding the repeated controversey associated with open water disposal. At the same time, new bird and wildlife habitat would be created.

The smaller facilities would have smaller adverse effects. Social impacts at the Morris Cove underwater borrow pit would, in fact, be minimal; and filling in part of Yellow Mill Channel is quite popular locally because of benefits realized over its long term, ultimate use. Clinton Harbor would satisfy local dredging needs for 25 years, while ultimately replacing lost marsh and protecting existing wetlands. Fayerweather Island appears to have the greatest unfavorable social impacts compared to the benefits a dredged material containment facility would give to the area.

TABLE 2

CHARACTERISTICS OF 49 DREDGING/DISPOSAL PERMITS IN CONNECTICUT IN 1979 AND 1980

No. of Permits	Town/City/Port	Amount of Dredged Material (cu yd)	Number of Objections Agency	Public	Total
6	Clinton	91,200	3	2	5
6	Groton	1,965,700	1	1	2
4	East Norwalk	21,170	0	2	2
4	Darien	3,550	1	0	1
4	Milford	57,445	0	1	1
3	Norwalk	5,000	0	1	1*
3	Westbrook	4,680	5	0	5
2	New Haven	34,500	0	0	0
2	South Norwalk	15,600	0	1	1
2	Cos Cob	4,300	2	1	3
1	Rowayton	9,500	0	4	4
1	Shelton	105,000	2	0	2
1	Branford	1,000	0	1	1
1	Chester	2,200	0	1	1
1	Essex	6,500	0	1	1
1	Greenwich	2,000	0	0	0
1	Haddam	29,000	0	0	0
1	New London	31,675	0	0	0
1	Noank	200	0	0	0
1	Old Saybrook	3,600	0	0	0
1	West Haven	16,000	0	0	0
1	Westport	2,400	0	0	0
1	Riverside	Unknown, small	0	0	0
TOTAL: 49 Permits 23 Sites		2,412,220	14	16	30*

* Two objections not listed here applied to nondredging aspects of a Norwalk permit.

SOURCE: "Social & Economic Impacts of Selected Potential Dredged Material Containment Facilities in Long Island Sound", report by The Center for the Environment & Man, Inc., September 1981.

TABLE 3

AGENCY OBJECTIONS TO CONNECTICUT DREDGING/DISPOSAL PROJECTS, 1979-1980

Agency	Objection	Included in Permits as Mitigation Measure or Special Condition
U.S. Fish & Wildlife Service	Wetland disturbance.	Yes
	Disposal on tidal wetland.	Yes
	No dredging in intertidal marsh.	Yes
CT DOA Aquaculture Division	No work during 1 June - 30 September.	Yes
	Disposal on tidal wetland.	Yes
	Salinity of water may change, due to project.	No
Groton Conservation Commission	Want overall, long range plan developed for all Thames River activities and projects.	No
Five Mile River Commission	Dredging should not extend more than 5-7 feet below MLW.	Yes
Westbrook:		
Planning Commission	Disposal on tidal wetland.	Yes
Conservation Commn.	Disposal on tidal wetland.	Yes
Harbor Commission	Disposal on tidal wetland.	Yes
NMFS	No dredging in intertidal marsh.	Yes
Fairfield Co. Soil & Water Conservation District	Want environmental impact statement prepared.	No

SOURCE: "Social & Economic Impacts of Selected Potential Dredged Material Containment Facilities in Long Island Sound", report by The Center for the Environment & Man, Inc., September 1981.

TABLE 4

GENERAL PUBLIC OBJECTIONS TO CONNECTICUT DREDGING/DISPOSAL PROJECTS, 1979-1980

Location	Objection	Included in Permit as Mitigation Measure or Special Condition
Clinton	Noise and water pollution.	Yes
Clinton	Possible runoff and odor.	Yes
Groton	Object to open water disposal.	Yes*
E. Norwalk	Adverse aesthetic and environmental impacts.	Yes
Milford	Object to open water disposal.	Yes*
Norwalk	Object to open water disposal.	Yes*
S. Norwalk	10-year permit for dredging is too long.	No
Cos Cob	Dredging will cause siltation of basin.	No
Rowayton (4)	Object to open water disposal. Boundary unclear.	Yes*
Branford	Object to open water disposal.	Yes*
Chester	Runoff will encroach on neighbor's land.	Yes
Essex	Object to open water disposal.	Yes**

*Special conditions put on open water disposal.

**Disposal on land instead of open water.

SOURCE: "Social & Economic Impacts of Selected Potential Dredged Material Containment Facilities in Long Island Sound", report by The Center for the Environment & Man, Inc., September 1981.

TABLE 5

SITE CHARACTERISTICS

Site Name	Harbor	Capacity (10^6 cu yd)	Area (acres)	Dike Height above MLW (ft)	Total Dike Length (ft)	Filling Time (yrs)	Ultimate Use
1. Fayerweather Island	Black Rock	1.4	52	15	3,800	1-2	Bird Refuge
2. Yellow Mill Channel	Bridgeport	0.5	16.5	15	500	1-2	Recreation-al Fields
3. Morris Cove	New Haven	0.9	33.0	0	None	1-2	Shellfish Habitat
4. Clinton Harbor	Clinton	0.31	24.0	9	4,400	25*	Bird Refuge
5. Twotree Island	Waterford	3.4	80.0	20	7,700 +1,500	15-30	Bird Refuge
6. Black Ledge	New London	11.0	190.0	20	12,000 +4,400	30+	Bird Refuge

*Dredged material would come only from Clinton Harbor.

Source: "Social & Economic Impacts of Selected Potential Dredged Material Containment Facilities in Long Island Sound", report by The Center for the Environment & Man, Inc., September 1981.

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
PROTOTYPE REPORT
GEOTECHNICAL ENGINEERING BRANCH

US Army Corps of Engineers

New England Division

Engineering Division

Geotechnical Engineering Branch

Waltham, Massachusetts 02254

April 1982

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
PROTOTYPE REPORT
GEOTECHNICAL ENGINEERING BRANCH

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1. Regional Topography. The coastal area of Connecticut lies within the Seaboard Lowland section of the New England physiographic province. The lowland is generally characterized by a seaward sloping area that is roughly planar. The lowland in Connecticut extends inland up to 20 miles and usually lies under elevation 500 feet NGVD.[1]

The relatively low elevation of the seaboard lowland section in Connecticut is primarily not a function of weak rock, as the underlying igneous and metamorphic rocks are very competent. The present-day topographic features are caused by erosion of the pre-existing features and subsequent deposition resulting from glaciation. Relative sea level rise has slightly modified the topography along coastal areas.

2. Regional Geology. The lowland area of Connecticut between the cities of Guilford and Mystic is underlain by early to mid-Paleozoic igneous and metamorphic rocks. The igneous rocks consist primarily of granite, with smaller occurrences of tonalite and quartz monzonite. Pegmatite bodies are also prominent. The metamorphic rocks consist of gneiss, granite gneiss, and lesser amounts of amphibolite and schist.

Bedrock in the area is covered primarily by glacial till and glacially-deposited, roughly-stratified sand and gravel deposits. In the areas along the coast, the glacial deposits are overlain by a recent depositional sequence of lagoonal silt, peat and organic silt, and beach sand and gravel. Recent alluvial deposits of sand, silt, and gravel are found along river valleys. Extensive tracts of artificial fill are found throughout the area.

3. Seismicity. The lowland area of Connecticut is located in Zone 1 of the seismic zone map of the United States. This is a modification of the seismic risk map developed by the Environmental Science Administration and the Coast and Geodetic Survey and it is contained in Engineering Regulation 1110-2-1806 dated 30 April 1977. In accordance with this directive, a coefficient of 0.025 g is recommended for use in any evaluation of seismic stability of structures in final design.

[1]National Geodetic Vertical Datum (NGVD) is the mean sea level of 1929.

Detailed remote sensing and fault compilation did not reveal the presence of a major or capable fault within Connecticut or Rhode Island. Since 1568, 85 earthquakes have occurred in these two states. With respect to Clinton Harbor site, the nearest event with an epicenter based on historical data occurred approximately four miles from the site in 1948 with an intensity of II MM (Modified Mercalli), and the nearest event with an epicenter based on instrumental data occurred approximately 20 miles from the site in 1940 with an intensity of IV MM. With respect to the Black Ledge site, the nearest event with an epicenter based on historical data occurred approximately four miles from the site in 1827 with an intensity of IV MM, and the nearest event with an epicenter based on instrumental data occurred approximately 13 miles from the site in 1976 with an intensity of II MM.

4. Foundation Investigations. A detailed field reconnaissance of the sites was performed in June 1981 in order to describe and photograph existing conditions.

From November 1981 through January 1982, a preliminary subsurface exploration program consisting of machine probings and borings, was performed in order to define foundation conditions. A total of 11 probes and 3 borings were performed at Clinton Harbor Site and 22 probes and 5 borings were performed at the Black Ledge Site. Locations and depths of the explorations are shown on Plates 3 and 4 "Plan of Explorations and Geologic Profile", for both the Clinton Harbor and Black Ledge Sites. The graphic logs for the explorations at Clinton Harbor and Black Ledge are shown on Plates 5 and 7 respectively.

Overburden samples recovered from the exploration program were tested at the New England Division Materials and Water Quality Laboratory for the following: gradation, both by sieve and hydrometer; Atterberg Limits; organic contents; water content; and specific gravity. See Plates 1 and 2, Soil Test Results, for overburden test results for each site. The bedrock samples from Black Ledge were tested for specific gravity, absorption, and unconfined compressive strength.

5. Site Geology.

a. Clinton Harbor.

(1) Topography. The topography of the Clinton area is primarily glacially controlled. The area is generally flat, with the only relief being provided by till hills and end moraine. Maximum elevation in the area is approximately 15 feet NGVD. The offshore area is generally flat, with boulders providing some relief. Minimum offshore elevation at the site is approximately -8 feet NGVD.

(2) Surficial Geology. In general, Pleistocene-age, glacial deposits are dominant in the low-lying coastal areas. Overburden cover in the area appears to average 50 feet in thickness. The distribution of surficial materials is shown on Plate 6.

Glacial till in the area is a compact, non-sorted mixture of clay, silt, sand, gravel, cobbles, and boulders deposited by glacial ice. The till is found overlying bedrock and is exposed at the higher elevations of Hammonasset State Park. End moraine is found along Hammonasset Point and it projects through West Rock and Wheeler Rock across Clinton Harbor to Hammock Point. The end moraine in the area consists of northeast-southwest trending ridges and elongate mounds of till and stratified drift with local concentrations of large boulders.

Ice-contact stratified drift in the area is a somewhat deformed mixture of sand, gravel, silt, and clay that is poorly sorted with abrupt changes in grain size. These sediments were deposited in streams and temporary lakes in close relation to melting glacier ice. The ice-contact stratified drift deposits grade into glacial outwash deposits. These sediments consist primarily of sand and gravel showing cut-and-fill stratification. The stratified glacial deposits generally overlie till, although they overlie bedrock in areas where till is absent. These deposits tend to be found in valleys and flatter areas. Extensive area of outwash deposits are found throughout Clinton and Hammonasset State Park.

In addition to glacially-derived overburden, there is a relatively large sequence of post-glacial deposits. Lagoonal or estuarine deposits generally overlie the glacial deposits. They consist primarily of silt and organic silt with some shells and shell fragments. Swamp and marsh deposits, which overlie the lagoonal deposits, are the dominant surficial sediments in the Clinton-Hammonasset State Park area. These deposits consist of organic silt and clay with sand and peat fibers.

Lining the coast along Hammonasset Beach and Clinton Harbor to Cedar Island, and overlying the swamp deposits, is a sequence of beach sand and gravel and windblown sand. Extensive areas of land in Hammonasset State Park and along the coast in Clinton and Harborview have been filled. The fill is variable in composition from site to site but, in general, coarse sand and gravel are common fill materials.

Based on the borings and probes performed at Clinton Harbor, the recent sand and swamp sequence over most of the area is at least 40 feet thick. No glacial deposits were recovered from the boring samples; however, the refusals encountered in Boring B and Probe 8 may be attributed to boulders common to end moraine.

(3) Bedrock Geology. The Clinton Harbor area is underlain by an early to mid-Palezoic sequence of igneous and slightly metamorphosed igneous rocks. The principal rock types are granite, tonalite, and amphibolite. The bedrock geology is shown on Plate 6.

The Haddam tonalite is composed essentially of plagioclase, quartz and hornblende and/or biotite. Accessory minerals include ilmenite, magnetite, apatite, garnet, and zircin. The rock is generally light gray

in color with local bluish and yellowish areas. The grain size varies from fine to coarse although it is predominantly medium. Most of the tonalite has a widely spaced foliation produced by the parallel arrangement of biotite and/or hornblende.

The Clinton granite is composed essentially of microcline, quartz, plagioclase, and biotite. Accessory minerals include zircon, rutile, and traces of allanite and garnet. The granite is pink in color, medium to coarse-grained, and poorly foliated.

Amphibolite mixed with the tonalite is found in a zone along the contact between the tonalite and granite. The amphibolite is composed primarily of hornblende and plagioclase with small amounts of biotite and quartz. Common accessory minerals are sphene, magnetite or ilmenite, chlorite, garnet and apatite. The rock is commonly dark gray and is generally well-foliated.

The Haddam tonalite was emplaced earlier than the Clinton granite because of granite dikes within the tonalite. It is believed that the Clinton granite forms a dome-like structure within the tonalite, as is evidenced by the strikes of primarily foliation. The amphibolite zone most likely originated as a result of thermal metamorphism upon emplacement of the granite.

The subsurface investigation at Clinton Harbor did not recover bedrock; however, the Clinton granite directly underlies the project site. As previously noted, the refusal encountered in boring B and probe 8 may be top of bedrock or boulders common to glacial end moraine. The top of the rock surface at the site probably lies under at least 50 feet of overburden.

b. Black Ledge.

(1) Topography. The topography of the Black Ledge-Groton area is primarily controlled by bedrock, although glaciation has extensively modified the original topography. The region is characterized by hills corresponding to exposed bedrock and mounds of glacial till. Maximum elevation in the area is over 50 feet NGVD. The offshore area is generally flat, with numerous areas of resistant bedrock, such as Black Ledge, providing the relief. Minimum offshore elevation at the site is approximately -14 feet NGVD.

(2) Surficial Geology. In general, Pleistocene-age glacial deposits dominate the area, with recent deposits occurring in coastal and low-lying areas. Overburden cover in the area is quite variable, ranging between no cover to over 150 feet in thickness. The distribution of surficial materials is shown on Plate 6.

Glacial till in the area is compact, sandy and gravelly till grading into a loose sandy, gravelly, and bouldery till. Included in the till are lenses of stratified material. The till is found overlying bedrock, except in areas where bedrock is exposed. Till is exposed at the surface over most of the Groton-N. London area.

Glacial stream deposits in the area consist of silt, sand, and gravel in valley fills, kame terraces and ice-channel fillings. These glacial stream deposits are similar to the ice-contact stratified drift and outwash deposits noted at Clinton. The stream deposits generally overlie the till. An extensive area of these stratified deposits is located in the area around Trumbull Airport.

In addition to glacially-derived overburden, there are areas of recent deposits. In the coastal areas, marsh and beach deposits are common. The marsh sediments consist of partly decomposed organic materials mixed or interbedded with estuarine silt and sand. They generally overlie glacial deposits and are exposed in large tracts around Trumbull Airport. The beach deposits consist chiefly of well-sorted sand deposited by current and wave action. Pebbly and gravelly areas are common. The beach deposits tend to overlie the marsh deposits. Primary locations are found at Osprey, Shennecossett, and Bushy Point Beaches.

Low-lying areas in areas of higher elevations have numerous swamp deposits. These consist of partly decomposed organic material mixed or interbedded with silt and sand. Swamp deposits generally overlie glacial till and are associated with recent alluvium. The alluvium is comprised of silt, sand, and gravel and is confined to the floodplains of present streams. Extensive tracts of land, primarily alo the coast, have been filled. The fill is variable in composition from site to site, but in general, coarse sand and gravel are common fill materials.

Based on the borings and probes performed at Black Ledge, the thickness and nature of the overburden is quite variable. Thicknesses ranged from exposed bedrock to over 40 feet of cover. Up to 8 feet of recent organic, silty sand was recovered. Underlying this material was a sequence of compact gravel, sand, silt and varved clay, which may be glacial in origin. Refusals encountered by the probes are assumed to be bedrock and two of the five borings recovered bedrock samples.

(3) Bedrock Geology. The Black Ledge area is underlain by an early to late-Paleozoic sequence of igneous and metamorphic rocks. The principal rock types are granite, granodiorite, gneiss, and amphibolite. The bedrock geology is shown on Plate 6.

The Mamacoke Formation is a Cambro-ordovician sequence with two primary members. The lower unit consists of a distinctly to indistinctly-layered, light to dark gray, fine to medium-grained, biotite-quartz-plagioclase gneiss with minor schist and amphibolite. The upper member is a layered sequence of white to light gray, biotite-quartz-orthoclase

gneiss; calc-silcate gneiss; amphibolite; biotite-quartz-andesine gneiss and garnet-rich, quartz-sillimanite-biotite-andesine gneiss; and coarse grained granular amphibolite.

The New London gneiss overlies the Mamacoke and has three primary units. The lower unit is an indistinctly-layered, hornblende-biotite-quartz-plagioclase gneiss. The middle unit is a light gray, medium to fine-grained, massive, gneissic granodiorite, with local quartz monzonite. The upper unit consists of interlayered, light gray, granodioritic gneiss and amphibolite, with subordinate hornblende-plagioclase gneiss, alaskite, and granite gneiss.

The Monson gneiss overlies the New London gneiss. It is a gray to dark gray, medium to coarse-grained, distinctly to indistinctly layered, locally massive, hornblende-biotite-quartz-plagioclase gneiss. Small lenses and layers of alaskite and amphibolite are present.

The Alaskite gneiss is a member of the Mississippian-age Sterling Plutonic Group. It is an orange-pink, light tan to white, locally iron-stained, mostly fine-grained, indistinctly foliated granite and a fine to medium grained, well foliated granite gneiss. They occur in both concordant and discordant masses.

These rock formations are contained in a N50 W-trending, overturned anticline. The rocks in the project area are on the overturned limb, giving the impression that the older rocks overlie the younger ones. Foliation dip in the rocks ranges between 30° and 70°, but generally averages 50° to the north.

Bedrock samples were obtained from two of the borings. Boring A consisted of 1 foot of a light-gray, medium-grained, hornblende-biotite-quartz-feldspar gneiss grading downward to a granite. The two inch recovery in boring D revealed a light gray, medium-grained granite. Tentatively, the gneiss is assigned to the New London Formation and the granite is assigned to the Alaskite Gneiss Formation. Petrographic analysis of the samples will be performed in later stages of the study.

6. Foundation Conditions.

a. Clinton Harbor. As shown on Plate 3 (Clinton Harbor Site, Clinton, CT) the retention dike alignment extends from the West Shore of the harbor approximately 1,600 feet eastward to boring FD-C, then northeasterly 1,200 feet to boring FD-B, then approximately 2,000 feet north to the north shore of the harbor.

The ground elevation within the proposed retention dike alignment varies from mean high water (+2.75 NGVD) at the shoreline to about 7 feet below mean low water (-9.0 NGVD) at borings FD-C and FD-B.

As shown on the soil profile, Plate 3 and the Summary of Test Results, Plate 1, soil conditions in the foundation area consist of surficial deposits of granular soil overlying very soft organic silt of undetermined depth. The granular soil is predominantly loose, medium to fine sand with shell fragments interbedded with deposits of loose to moderately-compact, silty sand and moderately-compact gravelly sand. The depth of sand deposits vary from 7 feet thick at FD-A to 30 feet at FD-C. Standard penetration test values in the medium to fine sand range from zero (push) to 9 and averages about 7 blows per foot. The underlying fine grain soils consist of very soft, fine-sandy, organic silt (OL & OH) with shell fragments and peat fibers. Borings FD-A and FD-C, driven to depth of 40 feet, did not reach the bottom of the silt deposit. At boring FD-B the organic silt deposit was encountered at a depth of 21 feet and refusal at 26 feet. Standard penetration test values in the organic silt range from zero (push) to 3 blows per foot.

b. Black Ledge. As shown on Plate 4 (Black Ledge Site, Groton, CT) the retention dike alignment extends completely around Black Ledge located about 3,000 feet south from Avery Point and 2,500 feet east of the New London Harbor Navigation Channel. The proposed dike alignment extends southerly from boring FD-A approximately 2,000 feet to probe P-20, then turning and running southeasterly 2,400 feet to point C, from point C the dike extends northeasterly 1,650 feet to point B, then turning northwesterly for 3,200 feet back to boring FD-A.

The ground elevation along the proposed retention dike alignment varies from -10 feet MLW to -33 feet MLW with the average depth of -20.5 feet MLW (-21.5 feet NGVD).

As shown on the Soil Profile, Plate 4, and Summary of Soil Test Results, Plate 2, soil conditions in the foundation area consist of a surficial deposit of very loose silty sand with shell fragments and plant matter ranging in depth from 1 to 6 feet deep with standard penetration test values of zero (push). This deposit continues with slightly more consolidation from a depth of 2 to 6 feet with standard penetration test values ranging from 3 to 7 blows per foot.

In general, the surficial deposits are underlain by a stratum of moderately compact, granular soil ranging from fine sand (SP) to silty, gravelly sand (SM). This deposit ranges in depth from 4 to 12 feet with standard penetration values ranging from 14 to 100 blows per foot and averaging about 30 blows per foot.

Along the westerly half of the containment area (probe P-3 to probe P-21), the granular soil overlies very dense, silty, gravelly sand or bedrock. Probes P-2, P-3, P-20, and P-21 all hit refusal at depths from 2 to 11 feet below the ground surface. Bedrock was encountered in borings FD-A and FD-D at depths of 14 and 10 feet, respectively.

In the eastern half of the area, boring FD-B and FD-C extended 40 feet below ground surface without encountering bedrock. The moderately-compact, fine sand and silty, gravelly sand in this area overlies moderately-compact, inorganic silt (ML). With increasing depth this grades into moderately-stiff, silty clay (CL). Standard penetration test values in this fine-grained soil range from 9 to 85 blows per foot and average about 20 blows per foot. In boring FD-C, silty, gravelly sand was encountered below the silt zone at a depth of 33 feet, probably indicating that the bedrock surface is nearby.

7. Retention Dike Design.

a. Clinton Harbor (Typical Dike Cross Sections, Plate 8)

(1) Design Considerations.

(a) The containment dike crest elevation (+6.0 MLW) and the flatness of the side slopes (1 vertical on 2.5 horizontal) are based on stability considerations due to the soft foundation conditions.

(b) The method of placement of the dike material is dictated by the shallow water depth which rules out barge placement.

(c) The material selected for the dike core (quarry spalls) must be strong enough to support the trucking and placement equipment and resist erosion from tidal fluctuations during construction. This material may be too pervious to satisfactorily retain suspended sediments in the containment area. To alleviate this condition, a gravel layer 18 inches thick will be placed on the containment side slope to blanket the quarry spalls and if necessary, plastic filter fabric will be placed over the gravel blanket when depositing dredged material.

(d) Slope protection requirements on the ocean side of the dike are dictated by design wave heights (4 and 6 feet).

(e) Crest and landside slope protection against wave action and overtopping from the design waves. The crest of the dike is protected by extending the rock slope protection over the top; however, the gravel blanket placed on the containment side slope to retain dredge material fines may be damaged by overtopping waves. It is expected that periodic maintenance will be required to replenish the gravel blanket until the containment area is filled.

(2) Dike Stability. The dike crest elevation and side slopes were analyzed for stability using the wedge method of planes and criteria described in EM 1110-2-5008 dated 15 October 1980. The assumed design strengths for the 6 feet above mean low water (+4 NGVD) with side slopes 1 vertical on 2.5 horizontal provides a factor of safety for stability of 1.3 which is the minimum factor of safety recommended in EM 1110-2-5008 for the end of construction condition.

Stability analyses were run assuming an embankment core material of bank run gravel with an angle of internal friction of 30 degrees, however, the dike design was later revised using a core material of quarry spalls. Additional stability analyses were not run on the revised dike as the quarry spalls are assumed to have a friction angle greater than 30 degrees and a stability analysis would result in a factor of safety greater than 1.3 which was obtained with the bank run gravel.

TABLE I

MATERIAL	UNIT WEIGHT (lbs/FT^3) Sat.	Sub.	SHEAR STRENGTH $\emptyset$	$C(lbs/FT^2)$
Emb. - bank run gravel	130	65	30^o	0
Fdn. - loose sand	-	55	25^o	0
Fdn. - soft organic silt	-	45	0	200 psf

(3) Construction Considerations. Hauling of the core material will be by truck from land borrow areas. Placement will be by dumping from the trucks and spreading by bulldozer, starting from shore and progressing outward. The top of the core material will be maintained at elevation +3 MLW (+1 NGVD) which is about 2 feet below mean high tide and will require a work schedule coordinated with the tide movement. After the dike core is placed, riprap slope protection will be placed by crane operating from the dike core at elevation 3 MLW. Source of core material and slope protection will be quarry rock hauled by truck overland from quarries within an estimated 30 mile radius of the site.

(4) Slope Protection. Stone sizes for the slope protection on the ocean side of the dike were determined from criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection Manual and Coastal Engineering Note TN 111-1, Riprap Revetment Design. Slope protection was designed for two wave heights for which different portions of the alignment will be subjected, i.e. H of 4 feet and 6 feet overtopping of the dike (elev. 6 MLW) (+4 NGVD) will occur with waves of this magnitude. The crest of the dike will be protected against erosion from overtopping by extending the slope protection over the top of the dike. Erosion of the gravel blanket on the containment side slope is likely to occur from overtopping waves of the design magnitude and periodic maintenance to replenish the gravel blanket should be anticipated.

b. Black Ledge (Typical Dike Cross Sections, Plates 9 and 10).

(1) Design Considerations.

(a) The proposed retention dike will be built in 5 to 35 feet of water.

(b) The core material must have a gradation capable of retaining the suspended dredge material within the containment area.

(c) The elevation to which the core material is carried dictates the quantity of dredge material that can be disposed at the site for a given alignment.

(d) The depth of water (5 to 35 feet) and distance offshore (1/2 mile) necessitates transport of all construction materials by barge.

(e) Slope protection requirements are dictated by design wave heights and overtopping potential.

(2) Dike Stability. Dike cross sections were analyzed for stability using the wedge method of planes and criteria described in EM 1110-2-5008 dated 15 October 1980. The assumed design strengths for the foundation and embankment materials are shown on Table II. Typical retention dike cross sections as shown on Plates 8 and 9 were designed to exceed a minimum factor of safety for stability of 1.3 as recommended in EM 1110-2-5008 for the end of construction condition.

TABLE II

MATERIAL	UNIT WEIGHT (lbs/FT^3) Sat.	Sub.	SHEAR STRENGTH ∅	C(lbs/FT^2)
Emb. - rock core material	130	65	40	0
Fdn. - compact sand	-	60	33	0
Fdn. - loose sand	-	55	30	0
Fdn. - loose silt	-	45	0	0

(3) Construction Considerations. The rock core material, as well as the stone slope protection, will be supplied from coastal quarries located within a 40 mile radius of Black Ledge, all materials will be transported by water-borne barges. Placement of the core material will be by bottom dump barges to about elevation -10 feet MLW (-11 NGVD). Above this elevation, placement will be by cranes operating from floating barges. The crest elevation of the core will be maintained at +6 MLW (+5 NGVD) which will provide 3 feet of free board above the mean high water level. Once a section of the core has been completed, the required bedding stone layers and stone slope protection will be placed by crane operating from floating barges adjacent to the dike.

(4) Slope Protection. Stone sizes for the slope protection system were determined from criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection Manual and Coastal Engineering Technical Note TN III-I, Riprap Revetment Design. Slope protection was

designed for two design wave heights (H) of 4 ft. and 6 ft. which different portions of the proposed alignment will be subjected. Overtopping of the dike will occur with waves of this magnitude. To protect the dike against overtopping the slope protection will be placed over the crest and down the inside slope of the retention dike to an elevation of -6 feet MLW (-7 NGVD). Typical dike sections are shown on Plates 8 and 9.

8. Construction Materials.

a. Clinton Harbor. Based upon preliminary estimates, the following material will be required to construct the Clinton Harbor containment facility:

CONSTRUCTION MATERIALS, CLINTON HARBOR SITE (Revised)

MATERIAL	QUANTITY
1,000 - 1,500 lb. Armor Stone	13,100 c.y.
200 - 400 lb. Armor Stone	4,900 c.y.
1 - 150 lb. Quarry Chips	44,750 c.y.
Gravel (bank run)	3,000 c.y.

The quarried rock material of suitable quality and sufficient resistance to weathering and disintegration is available from commercial suppliers within a 30 mile radius of the study site. Gravel material in the quantity needed is available from several developed and undeveloped sources within a 30 mile radius of the site.

b. Black Ledge. Based upon preliminary estimates, the following material will be required to construct the Black Ledge containment facility:

CONSTRUCTION MATERIALS, BLACK LEDGE SITE (Revised)

MATERIAL	QUANTITY
1,000 - 2,000 lb. Armor Stone	88,800 cy
300 - 600 lb. Armor Stone	27,000 cy
100 - 200 lb. Underlayer Stone	162,600 cy
30 - 60 lb. Underlayer Stone	42,000 cy
Quarry spalls to 50 lb.	883,800 cy

The quarried rock material of suitable quality and sufficient resistance to weathering and disintegration is available from commercial suppliers within a 40 mile radius of the study site. It may be necessary to obtain the desired quantity of quarry spalls from a combination of suppliers.

9. Conclusions and Recommendations.

a. Poor foundation conditions exist at both the proposed Clinton Harbor and Black Ledge dredge containment sites. The originally proposed alignments at both sites were altered to avoid deep water and 5 to 7 feet of soft soil (0 blow counts) at the Clinton site and up to 12 feet of soft soil (0 to 7 blow counts) at Black Ledge site.

b. Both the Clinton Harbor and Black Ledge sites will be subjected to large wave heights. The design wave heights are 6 feet at both sites.

c. Portions of the proposed Black Ledge retention dike alignment are in 35 feet of water. The depth of water in combination with design considerations for the large wave heights makes for a very large and expensive retention dike cross section.

d. Future siting of proposed dredge containment facilities should consider design wave heights for the particular site, available subsurface information, depth of water (if applicable) and construction methods (standard earth moving or barge construction).

e. Recommendation is made that prior to final design of Clinton Harbor or Black Ledge dredge containment facilities that a detailed subsurface exploration and soil testing program be carried out to refine the proposed alignments economizing the embankment cross sections.

COST ESTIMATE
BLACK LEDGE CONTAINMENT DIKE
GROTON, CONNECTICUT

ITEM	QUANTITY: NUMBER UNITS	QUANTITY: UNIT MEASURE	MATERIAL: PER UNIT	MATERIAL: TOTAL	TOTAL COST
BORING FD-A TO PROBE P-21 (2,900 L.F.)					
Quarry Spalls	400,690	C.Y.	$18.00	$7,212,420	
Underlayer Stone	90,625	C.Y.	$35.00	3,171,875	
Armor Stone	42,695	C.Y.	$65.00	2,775,175	
					$13,159,470
PROBE P-21 TO POINT C (1,500 L.F.)					
Quarry Spalls	127,100	C.Y.	$18.00	$2,287,800	
Underlayer Stone	22,990	C.Y.	$35.00	804,650	
Armor Stone	22,085	C.Y.	$65.00	1,435,525	
					$ 4,527,975
POINT B TO POINT C (1,650 L.F.)					
Quarry Spalls	174,000	C.Y.	$18.00	$3,132,000	
Underlayer Stone	49,000	C.Y.	$35.00	1,715,000	
Armor Stone	24,000	C.Y.	$65.00	1,560,000	
					$ 6,407,000
BORING FD-A TO POINT B (3,200 L.F.)					
Quarry Spalls	182,000	C.Y.	$18.00	$3,276,000	
Underlayer Stone	42,000	C.Y.	$35.00	1,470,000	
Armor Stone	27,000	C.Y.	$65.00	1,755,000	
					$ 6,501,000
TOTAL					$30,595,445

COST ESTIMATE
CLINTON HARBOR CONTAINMENT DIKE
CLINTON, CONNECTICUT

ITEM	QUANTITY NUMBER UNITS	QUANTITY UNIT MEASURE	MATERIAL PER UNIT	MATERIAL TOTAL	TOTAL COST
WEST SHORE TO M.L.W. (800')					
Armor Stone (1000-1500 lbs.)	1,822	C.Y.	$35.00	$63,770	
Quarry Chips	2,352	C.Y.	$15.00	35,280	
Gravel Fill	30	C.Y.	$10.00	300	
					$ 99,350
M.L.W. TO PROBE P-11 (200')					
Armor Stone (1000-1500 lbs.)	745	C.Y.	$35.00	$26,075	
Quarry Chips	1,583	C.Y.	$15.00	23,745	
Gravel Fill	104	C.Y.	$10.00	1,040	
					$ 50,860
PROBE P-11 TO BH-B (1900')					
Armor Stone (1000-1500 lbs.)	10,561	C.Y.	$35.00	$369,635	
Quarry Chips	29,407	C.Y.	$15.00	441,105	
Gravel Fill	2,148	C.Y.	$10.00	21,480	
					$ 832,220
BORING BH-B TO BH-A (800')					
Armor Stone (200-400 lbs.)	2,326	C.Y.	$35.00	$ 81,410	
Quarry Chips	6,430	C.Y.	$15.00	96,450	
Gravel Fill	474	C.Y.	$10.00	4,740	
					$ 182,600
BORING BH-A TO NORTH SHORE (1200')					
Armor Stone (200-400 lbs.)	2,563	C.Y.	$35.00	$ 89,705	
Quarry Chips	4,980	C.Y.	$15.00	74,700	
Gravel Fill	248	C.Y.	$10.00	2,480	
					$ 166,885
TOTAL					$1,331,915

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2. U. S. Army Coastal Engineering Research Center, 1977, Shore Protection Manual.

3. U. S. Army Coastal Engineering Research Center, 1979, Technical Note III-I Riprap Revetment Design.

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8. Haeni, F. P., 1974, Contour Map of the Bedrock Surface, Clinton Quadrangle, Connecticut. U. S. Geological Survey, Map No. MF 553A.

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10. Schairer, J. F., 1931, The Minerals of Connecticut. State Geologic and Natural History Survey, Bulletin No. 51, 117 pp.

SOIL TESTS RESULTS

EXPL. NO.	TOP ELEV. FT.	SAMPLE NO.	DEPTH FT.	SOIL SYMBOL	MECHANICAL ANALYSIS GRAVEL %	SAND %	FINES %	D_{10} mm.	ATT. LIMITS LL	PL	SPECIFIC GRAVITY	NAT. WATER CONTENT % DRY WT TOTAL	-NO4	COMPACTION DATA STND AASHO OPT. WATER % DRY WT	MAX DRY DENS LBS/CU FT	* PVD LBS/CU FT	NAT. DRY DENSITY LBS/CUFT TOTAL	-NO4	OTHER TESTS SHEAR	CONSOL	PERM	% Organic
FD-A	-3.4	5-1	0.0-2.0	SP	1	98	1	0.15	NP	–												
		5-2	5.0-7.0	SP-SM	0	92	8	[illegible]	NP													
		5-3	11.0-13.0	OL	0	36	64	0.006	36	[illegible]	[illegible]	46										
		"	" "	OL					NP.													
		5-4	15.0-17.0	OH	[illegible]	17	83	<.001	67	[illegible]	2.7[illegible]	73										2.65
		"	" "	OH					53d	[illegible]												
		5-5	22.022.0	OH	0	8	92	<.001	79	37	2.6[illegible]	88										
		5-6	33.0-35.0	OH	0	3	97	<.001	11[illegible]	[illegible]	2.[illegible]	112										4.94
		5-7	38-40.0	OH	0	2	98	<.001	117	60	2.[illegible]	116										
FD-B	-6.9	5-1	0.0-2.0	SP	1	97	2	0.110	–	–												
		5-2	5.0-7.0	SC	0	75	25	0.010	31	21	2.70	29										
		5-3	13.0-15.0	SP	0	100	0	0.350	–	–												
		5-5	23.0-25.0	OH	0	18	32	<.001	117	58	2.6[illegible]	120										
FD-C	-9.1	5-2	6.0-8.0	SP-SM	3	[illegible]	8	0.10	–	–	–	–										
		5-3	11.0-13.0	SP	38	57	5	0.13	–	–	–	–										
		5-5	30.0-32.0	OH	0	45	55	0.002	53	32	2.66	63										
		5-6	36.0-38.0	OH	0	12	88	<.001	[illegible]	38	2.69	58										[illegible]
		5-7	40.0-42.0	OL	0	[illegible]	64	.0015	49	29	2.70	67										
		"	" "	OL					39d	27d												

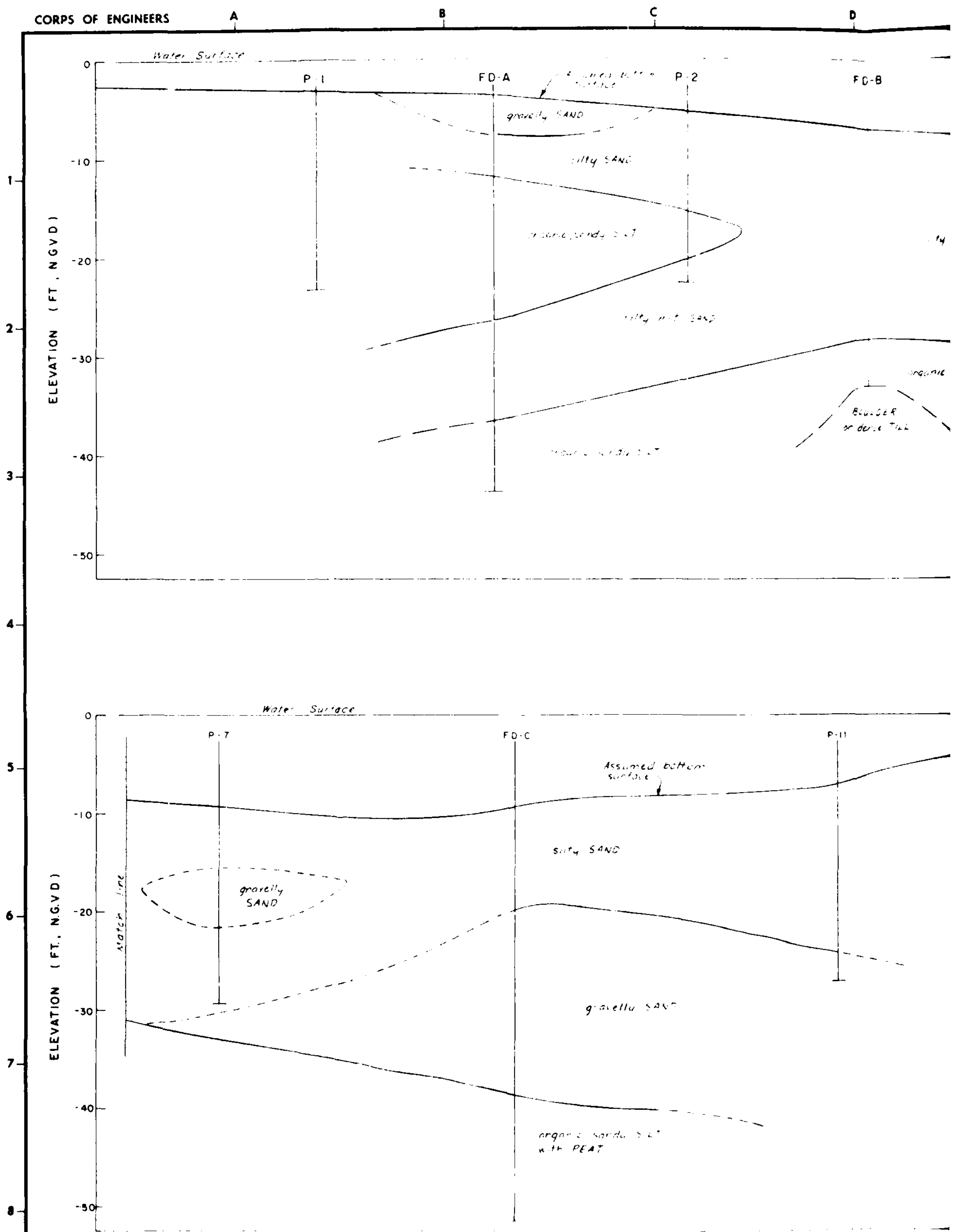
Elevation Datum is NGVD.
53d- LL&PL on oven-dry sample

NED FORM 510 JUN 63 * PROVIDENCE VIBRATED DENSITY TEST

SOIL TESTS RESULTS

EXPL. NO.	TOP ELEV. FT.	SAMPLE NO.	DEPTH FT.	SOIL SYMBOL	MECHANICAL ANALYSIS GRAVEL %	SAND %	FINES %	D_{10} mm.	ATT. LIMITS LL	PL	SPECIFIC GRAVITY	NAT. WATER CONTENT % DRY WT TOTAL	- NO4	COMPACTION DATA STND AASHO OPT. WATER % DRY WT	MAX. DRY DENS. LBS/CU FT	* PVD LBS/CU FT	NAT. DRY DENSITY LBS/CU FT TOTAL	- NO4	OTHER TESTS SHEAR	CONSOL.	PERM.
FD-A	-25.5	S-1	1.5-3.5	SM	29	57	14	0.04													
		S-2	5.5-7.5	SP	7	90	3	0.14													
		S-3	10.0-12.0	SM	30	50	20	0.03													
FD-B	-18.5	S-1	2.5-4.5	SM	1	55	44	-													
		S-2	6.5-8.5	SP	1	97	2	0.23													
		S-3A	12.5-13.5	SP	3	93	4	0.15													
		S-4	17.0-19.0	ML	0	17	83	0.015			2.68										
		S-5	22.5-24.5	ML	0	2	98	0.004	NP	NP	2.75	30.1									
		S-6	28.0-30.0	ML	0	4	96	0.002	27	22	2.73	32.7									
		S-7	33.0-35.0	OL	0	3	97	0.001	33	23	2.75	29.2									
		S-8	38.0-40.5	CL	0	5	95	0.001	30	21	2.75	33.2									
FD-C	-27.0	S-1	2.5-5.5	SC	26	56	18	-													
		S-2A	11.0-12.0	SP	37	62	1	0.30													
		S-2B	12.0-13.0	ML	0	4	96	0.007													
		S-3	15.5-17.5	ML	0	4	96	0.005	NP	NP	2.74	27.7									
		S-4	20.5-22.5	ML	0	3	97	0.001	29	27	2.70	31.6									
		S-5	25.5-27.5	CL	1	2	98	0.002	31	21	2.76	30.5									
		S-6	31.0-33.2	ML	36	15	84	0.003	NP	NP	2.70	26.1									
		S-7	33.2-40.5	SM		40	24	-													
FD-D	-27.0	S-1	1.0-3.0	GP-GM	50	38	12	-													
		S-2	6.0-8.8	SM	32	52	16	0.03													
FD-E	-30.0	S-1	0.0-6.0	ML	0	14	86	0.002													

CORPS OF ENGINEERS



PROFILE ALONG PERIPHERY OF DIKE ALIGNMENT

AD-A128 227 THE LONG ISLAND SOUND DREDGED MATERIAL CONTAINMENT FEASIBILITY STUDY(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 83

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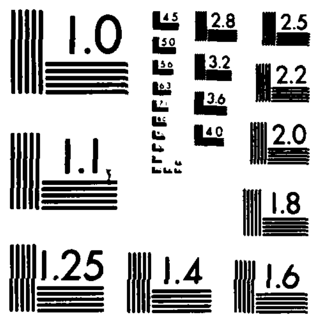
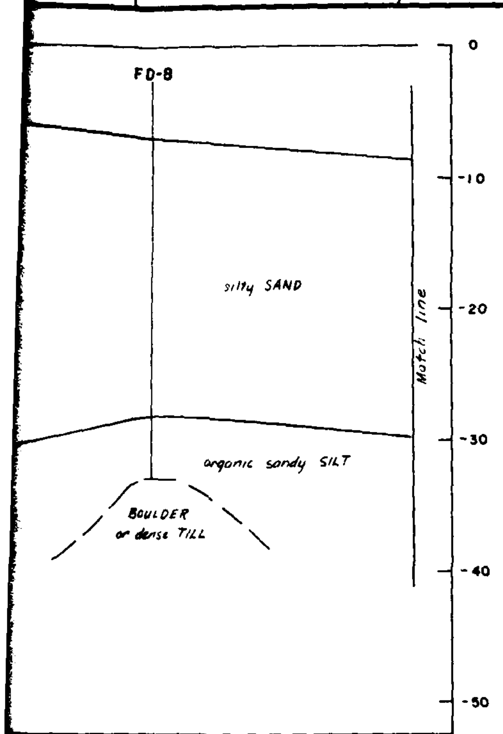
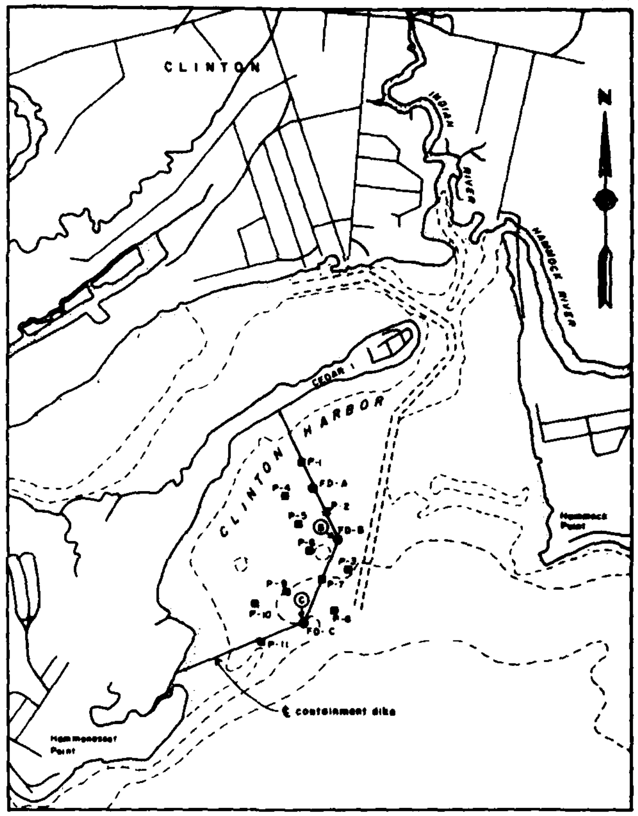


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

U. S. ARMY

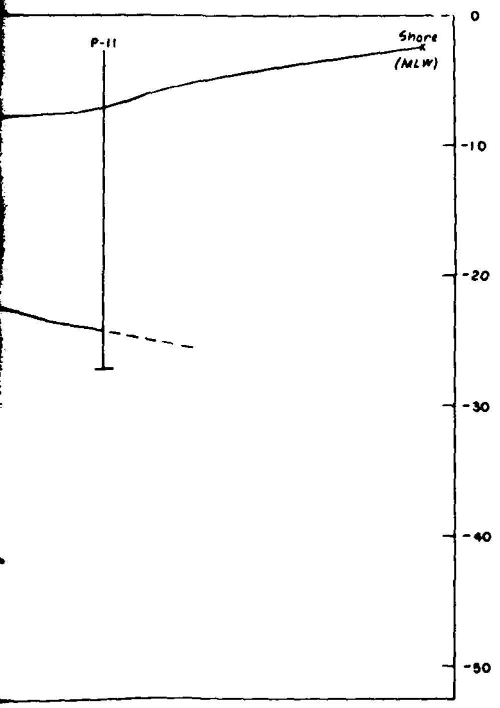




LOCATION MAP AND PLAN OF EXPLORATIONS

NOTES
- PROBE
- BORING
- Ⓑ CONTAINMENT FACILITY CORNER

GRAPHIC SCALE
500 0 500 1000 FT.



ALIGNMENT

NOTE
For Graphic Logs see Plate 5

GRAPHIC SCALES

HORIZ 100' 0' 100' 200'

VERT 5' 0 5' 10'

0.0 MLW = -1.95 N.G.V.D.

REVISION	DATE	DESCRIPTION	BY

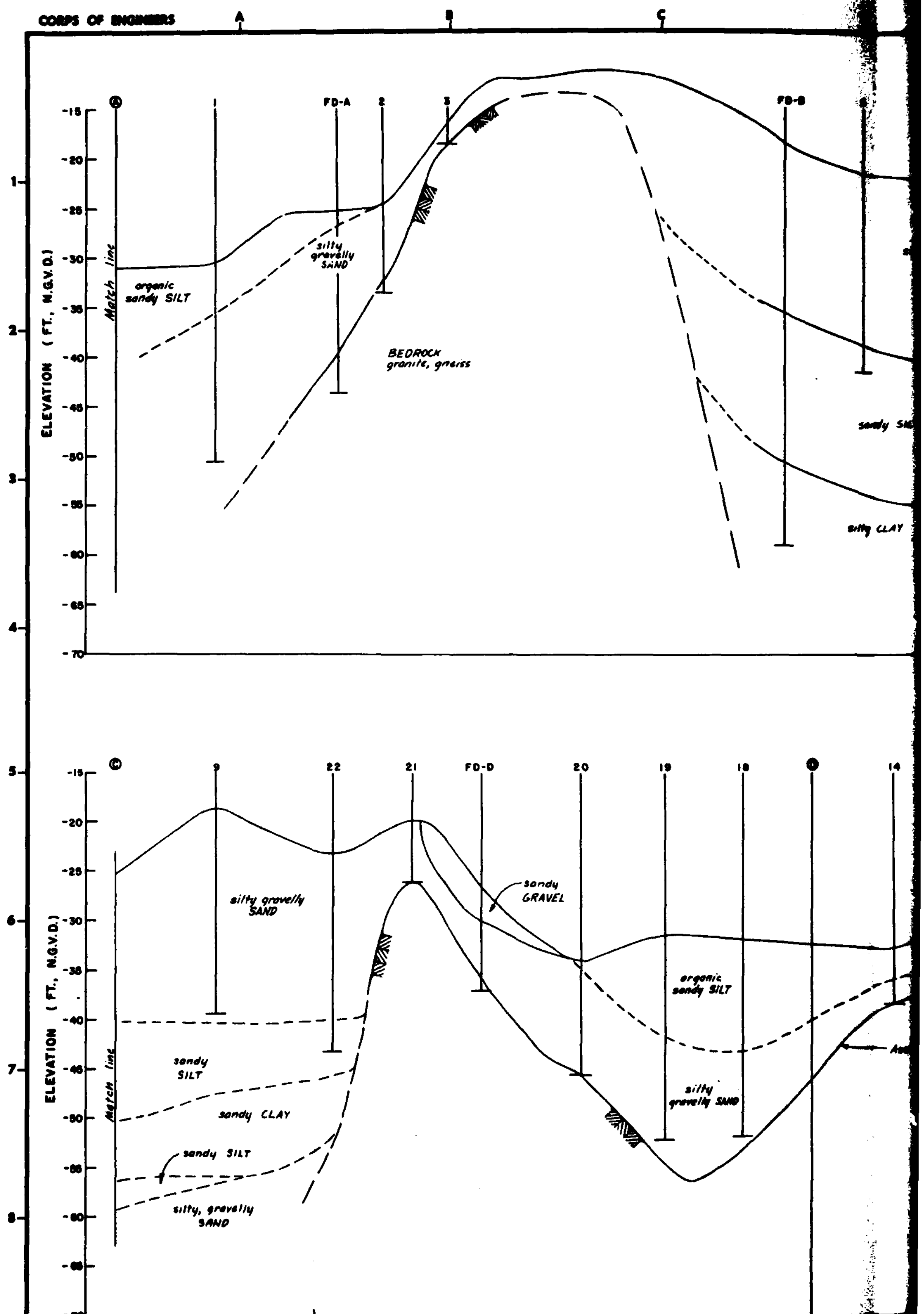
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
PLAN OF EXPLORATIONS AND PROFILE
PROPOSED CLINTON HARBOR SITE
CLINTON, CT.

GEOTECH. ENG. BR.
PLATE 3

SCALE: AS SHOWN
DATE: APRIL 1982

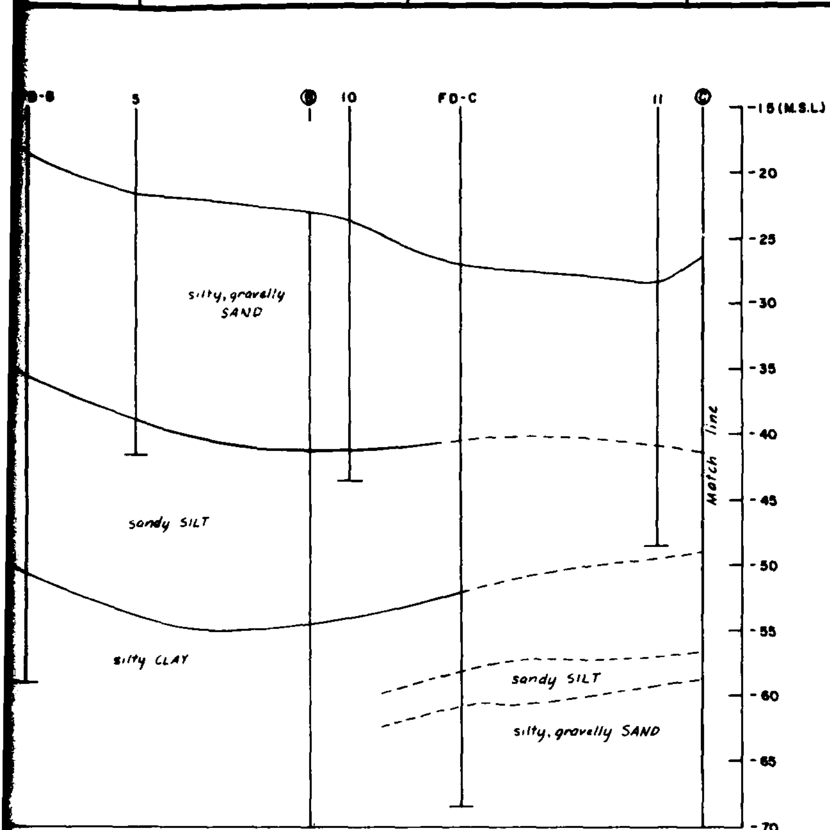
2

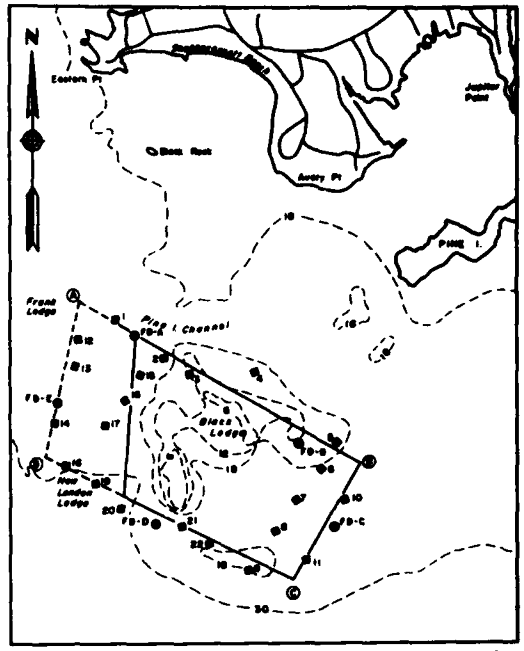


PROFILE ALONG PERIPHERY OF DIKE ALIGNMENT

D E F G H

U. S. ARMY





LOCATION MAP AND PLAN OF EXPLORATIONS

NOTES

- ■ PROBE
- ● BORING
- Ⓑ CONTAINMENT FACILITY CORNER
- ----ORIGINAL ALINEMENT CHANGED DUE TO FOUNDATION CONDITION

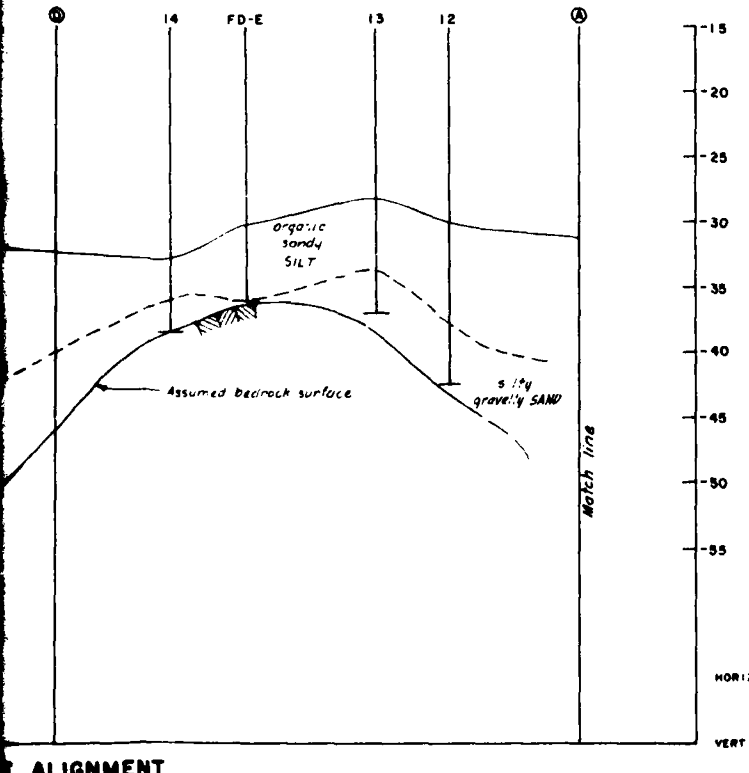
GRAPHIC SCALE

1

2

3

4



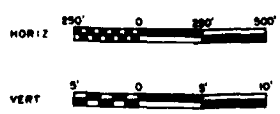
5

NOTE
For Graphic Logs see Plate 7.

6

7

GRAPHIC SCALES



0.0 MLW = -1.05 NGVD

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY:
DR. BY:
CK. BY:

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
PLAN OF EXPLORATIONS AND PROFILE
PROPOSED BLACK LEDGE SITE
GROTON, CT.

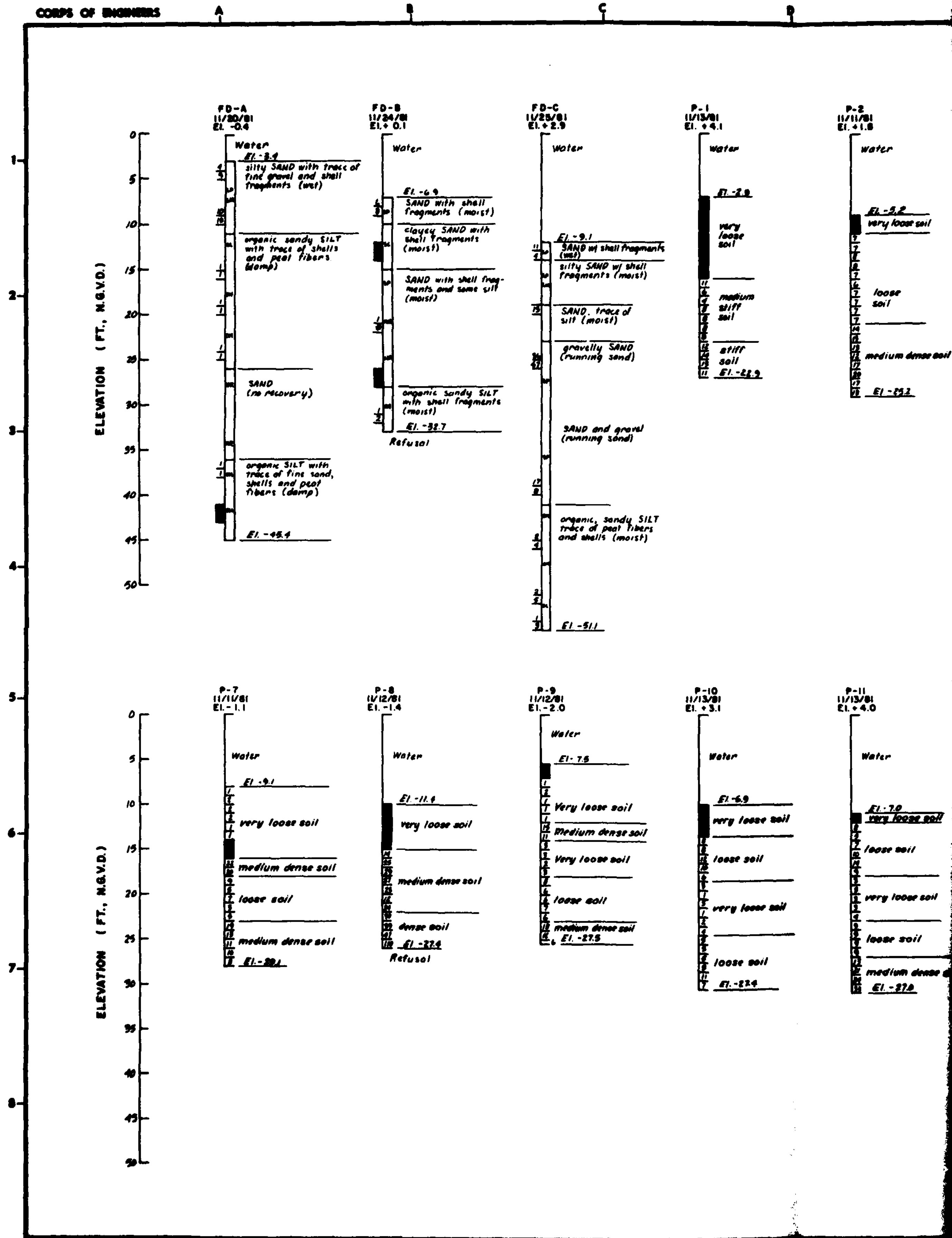
8

GEOTECH. ENG. BR.	SCALE: AS SHOWN
PLATE 4	DATE: APRIL 1982

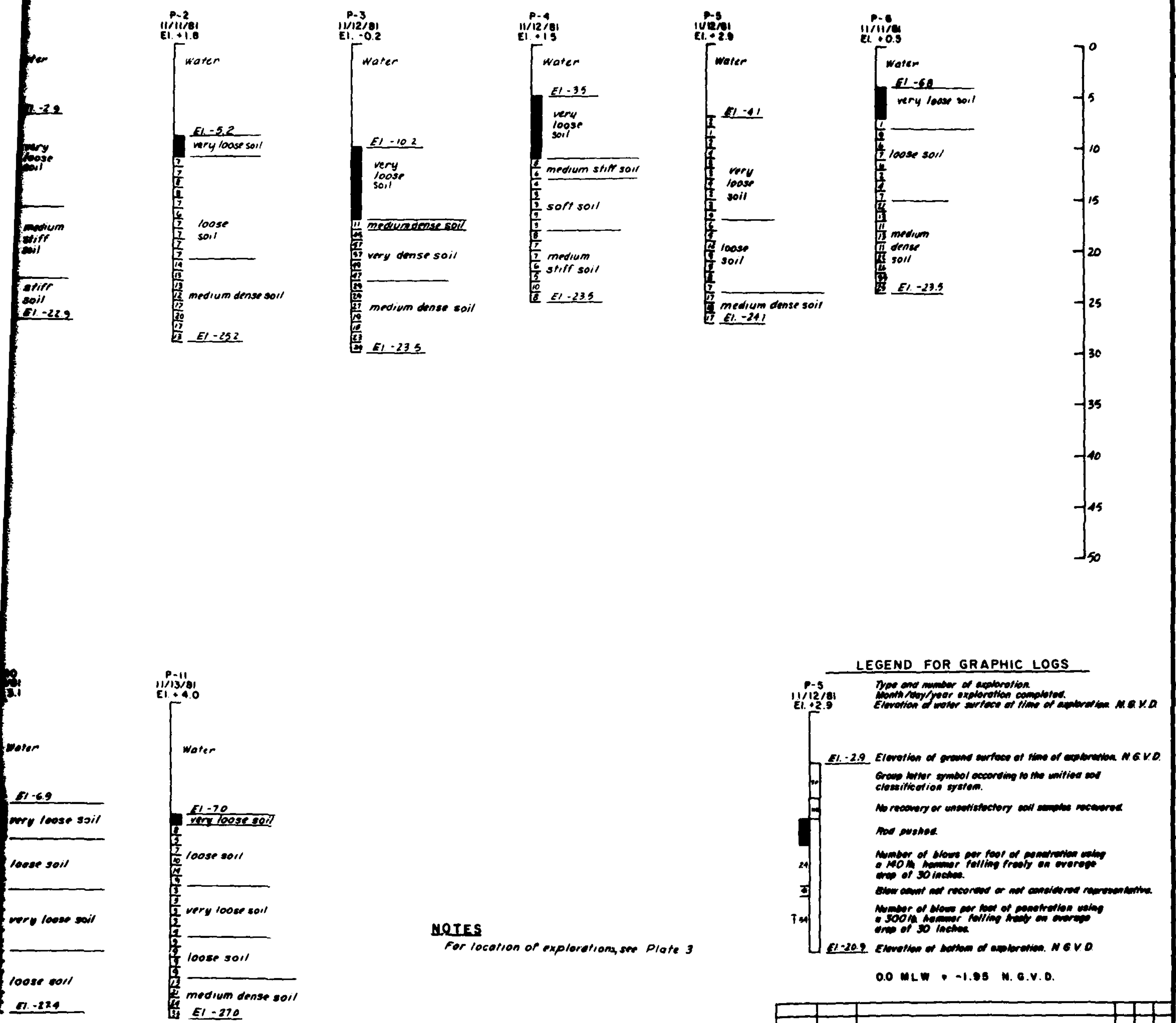
ALIGNMENT

2

CORPS OF ENGINEERS



U. S. ARMY



NOTES

For location of explorations, see Plate 3

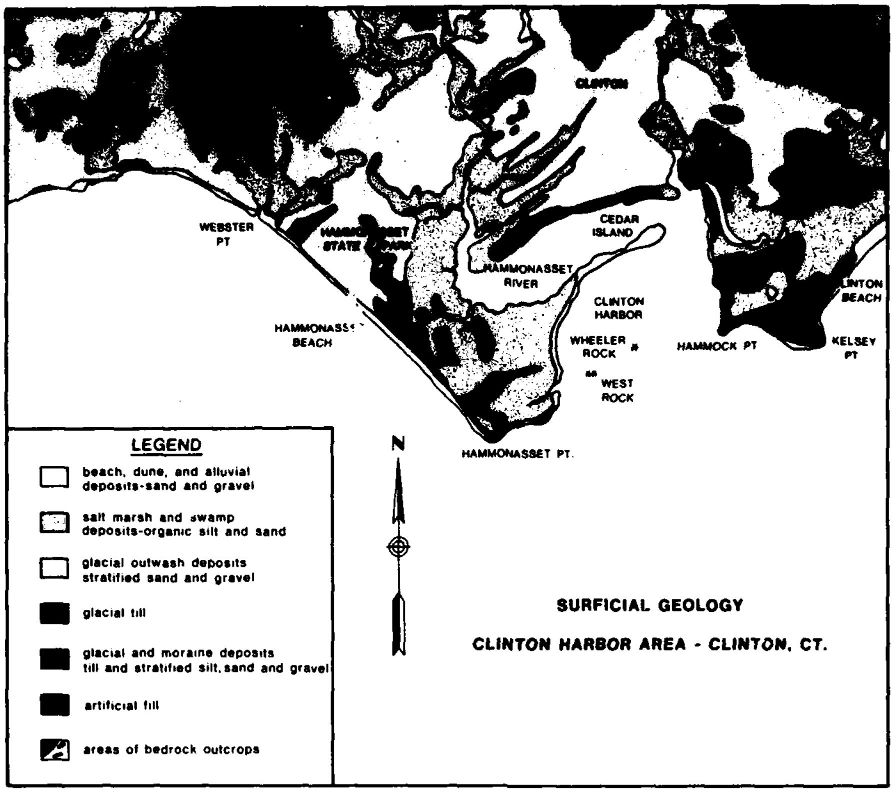
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GRAPHIC BORING AND PROBING LOGS
CLINTON HARBOR SITE
CLINTON, CT.

GEOTECH. ENG. BR.
PLATE 5

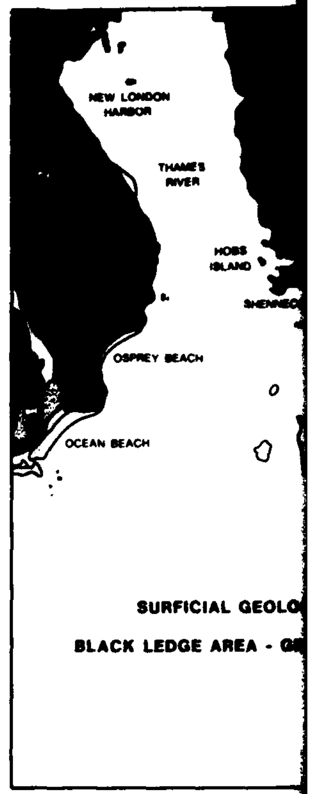
SCALE: AS SHOWN
DATE: APRIL 1982

2



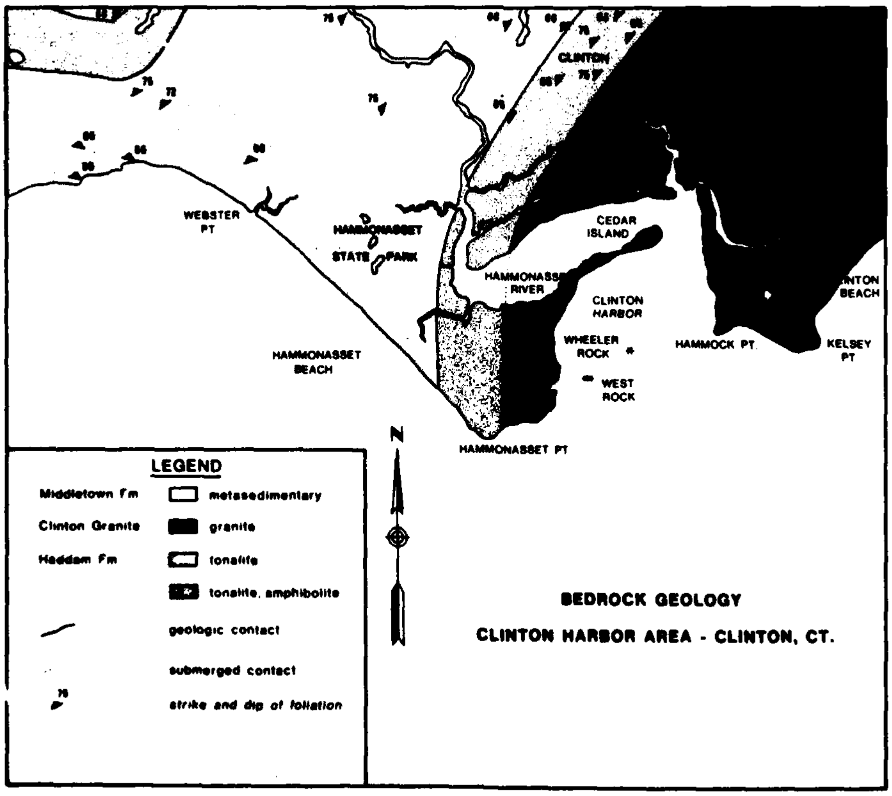
SURFICIAL GEOLOGY

CLINTON HARBOR AREA - CLINTON, CT.



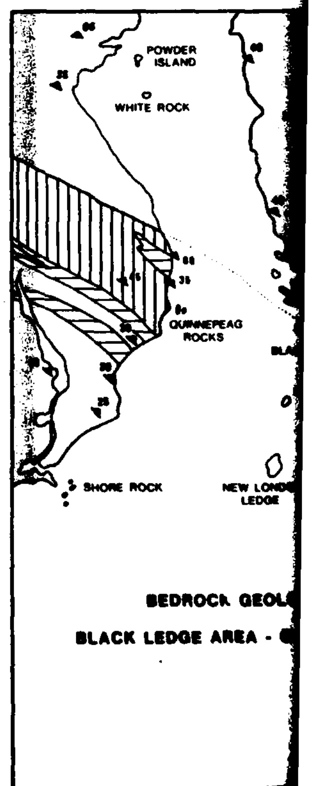
SURFICIAL GEOLO

BLACK LEDGE AREA - G



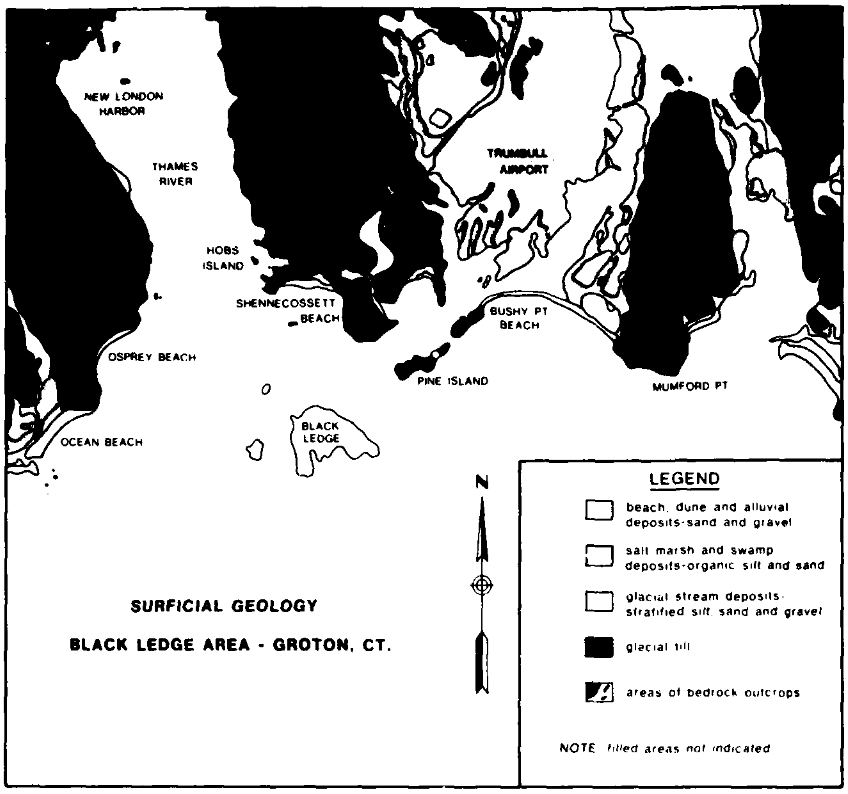
BEDROCK GEOLOGY

CLINTON HARBOR AREA - CLINTON, CT.



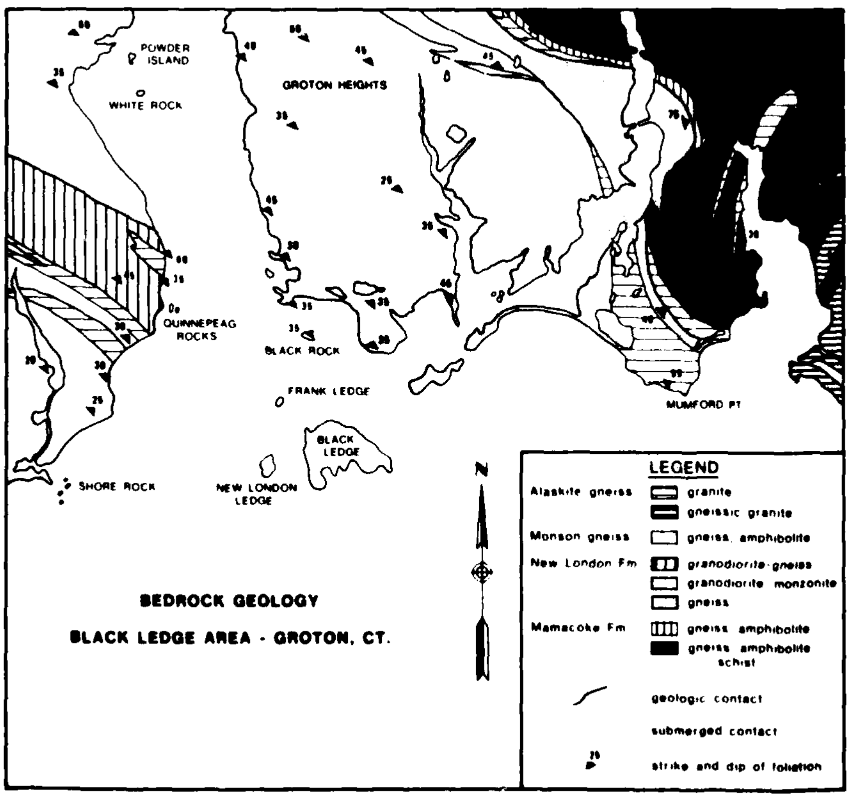
BEDROCK GEOL

BLACK LEDGE AREA -



SURFICIAL GEOLOGY

BLACK LEDGE AREA - GROTON, CT.



BEDROCK GEOLOGY

BLACK LEDGE AREA - GROTON, CT.

GRAPHIC SCALE

2000 0 2000 4000

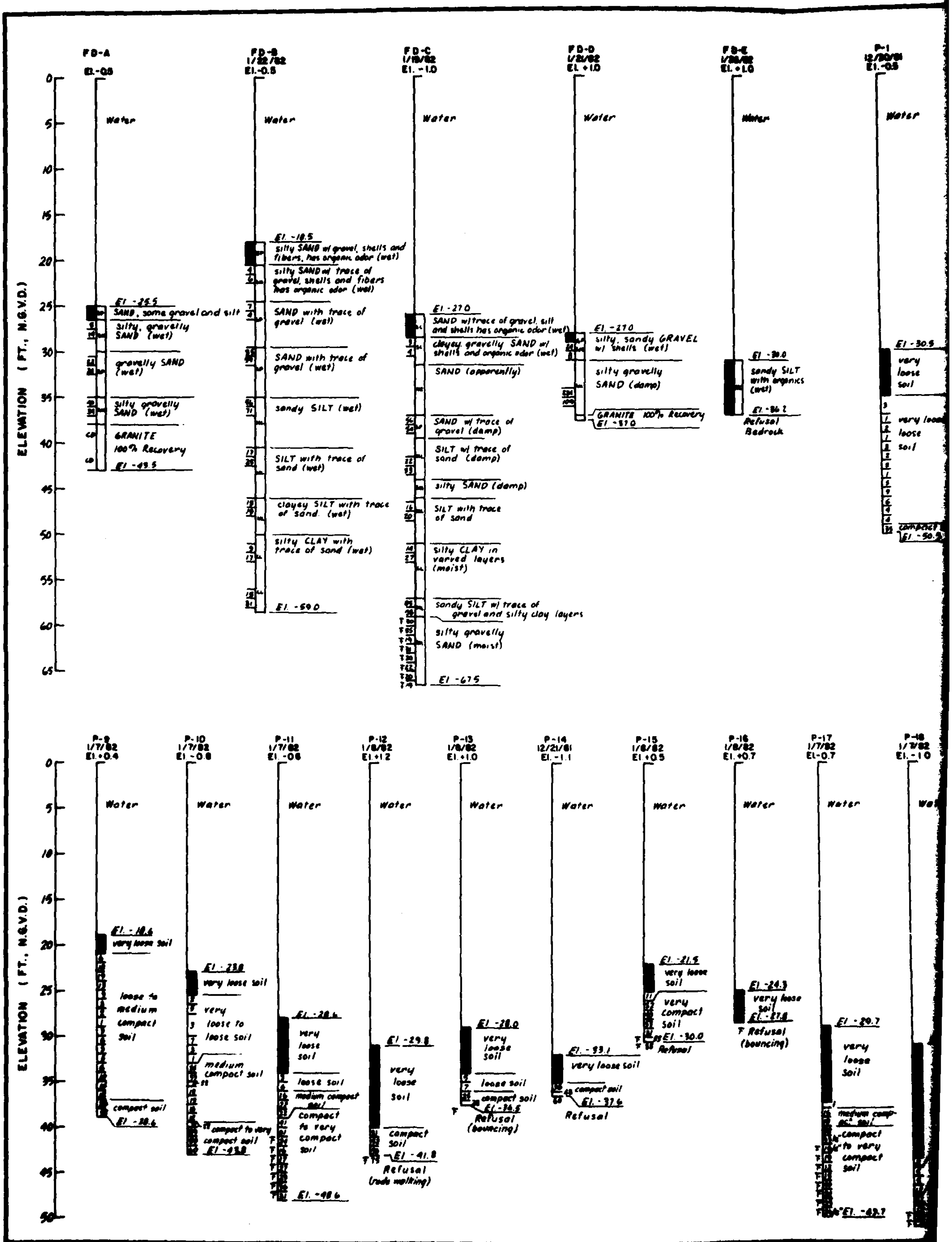
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

LONG ISLAND SOUND, CT.
BLACK LEDGE, CLINTON HBR.
GEOLOGIC MAPS

DES BY EB | DR BY EB | CK BY

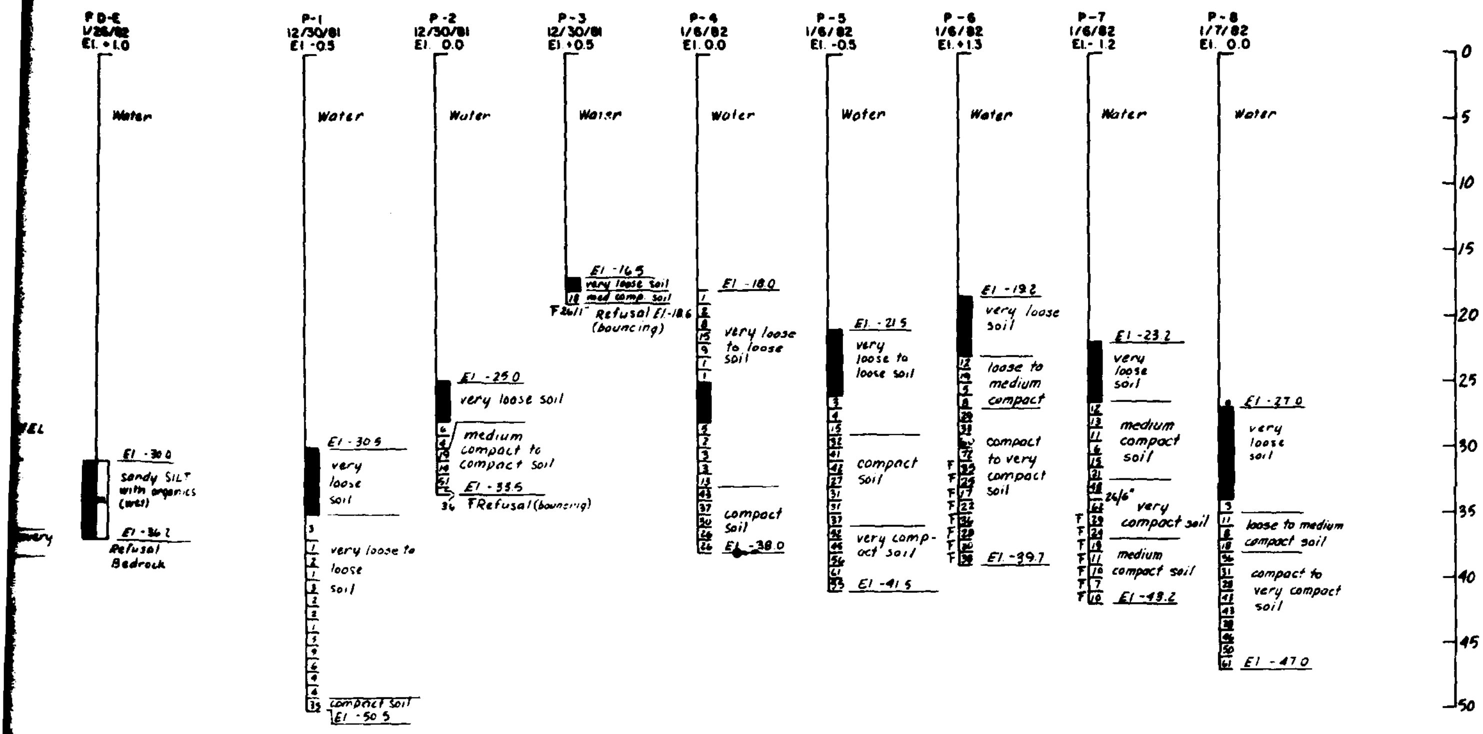
SUBMITTED | CHIEF SECTION | APPROVAL RECOMMENDED | REVIEWED | APPROVAL RECOMMENDED | APPROVED | DATE | SCALE | SPEC NO. | DRAWING NUMBER | SHEET

PLATE 6

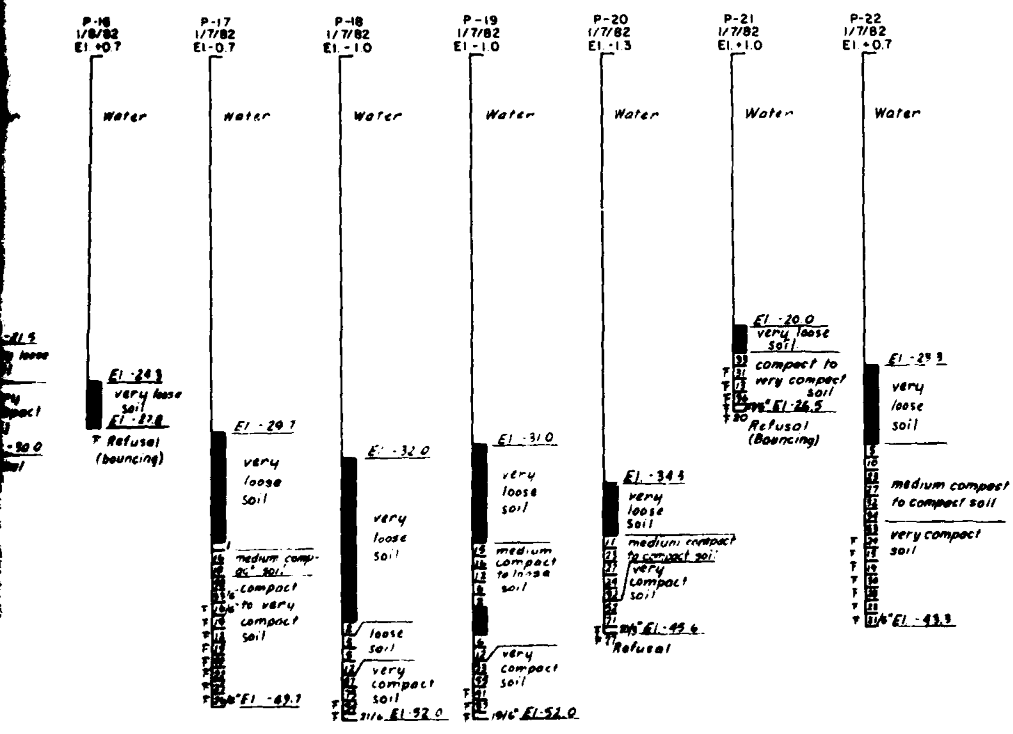


ELEVATION (FT., N.G.V.D.)
FD-A El. -0.5
Water
El. -25.5
SAND, some gravel and silt
silty, gravelly SAND (wet)
gravelly SAND (wet)
silty gravelly SAND (wet)
GRANITE 100% Recovery
El. -43.5
FD-B 1/22/82 El. -0.5
Water
El. -18.5
silty SAND w/ gravel, shells and fibers, has organic odor (wet)
silty SAND w/ trace of gravel, shells and fibers has organic odor (wet)
SAND with trace of gravel (wet)
SAND with trace of gravel (wet)
sandy SILT (wet)
SILT with trace of sand (wet)
clayey SILT with trace of sand (wet)
silty CLAY with trace of sand (wet)
El. -59.0
FD-C 1/19/82 El. -1.0
Water
El. -27.0
SAND w/ trace of gravel, silt and shells has organic odor (wet)
clayey gravelly SAND w/ shells and organic odor (wet)
SAND (apparently)
SAND w/ trace of gravel (damp)
SILT w/ trace of sand (damp)
silty SAND (damp)
SILT with trace of sand
silty CLAY in varved layers (moist)
sandy SILT w/ trace of gravel and silty clay layers
silty gravelly SAND (moist)
El. -67.5
FD-D 1/21/82 El. +1.0
Water
El. -27.0
silty, sandy GRAVEL w/ shells (wet)
silty gravelly SAND (damp)
GRANITE 100% Recovery
El. -37.0
FD-E 1/20/82 El. +1.0
Water
El. -31.0
sandy SILT with organics (wet)
El. -36.2
Refusal Bedrock
P-1 12/30/81 El. -0.5
Water
El. -30.5
very loose soil
very loose loose soil
compact
El. -50.5
P-9 1/7/82 El. +0.4
Water
El. -18.6
very loose soil
loose to medium compact soil
compact soil
El. -38.6
P-10 1/7/82 El. -0.8
Water
El. -23.8
very loose soil
very loose to loose soil
medium compact soil
compact to very compact soil
El. -43.8
P-11 1/7/82 El. -0.6
Water
El. -28.6
very loose soil
loose soil
medium compact soil
compact to very compact soil
El. -48.6
P-12 1/8/82 El. +1.2
Water
El. -29.8
very loose soil
compact soil
El. -41.8
Refusal (rods walking)
P-13 1/8/82 El. +1.0
Water
El. -28.0
very loose soil
loose soil
compact soil
El. -36.5
Refusal (bouncing)
P-14 12/21/81 El. -1.1
Water
El. -33.1
very loose soil
compact soil
El. -37.6
Refusal
P-15 1/8/82 El. +0.5
Water
El. -21.5
very loose soil
very compact soil
El. -30.0
Refusal
P-16 1/8/82 El. +0.7
Water
El. -24.5
very loose soil
El. -27.8
Refusal (bouncing)
P-17 1/7/82 El. -0.7
Water
El. -29.7
very loose soil
medium compact soil
compact to very compact soil
El. -49.7
P-18 1/7/82 El. -1.0

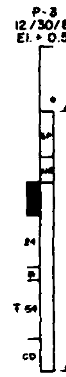
I



NOTE
For location of explorations, see Plate 4.



LEGEND FOR GRAPHIC LOGS



- *Type and number of exploration.*
- *Month/day/year exploration completed.*
- *Elevation of water surface at time of exploration, N.G.V.D.*
- *Elevation of ground surface at time of exploration, N.G.V.D.*
- *Group letter symbol according to the unified soil classification system.*
- *No recovery or unsatisfactory soil samples recovered.*
- *Rod pushed with weight of hammer and tools.*
- *Number of blows per foot of penetration using a 140 lb. hammer falling freely an average drop of 30 inches.*
- *Blow count not recorded or not considered representative.*
- *Number of blows per foot of penetration using a 300 lb. hammer falling freely an average drop of 30 inches.*
- *Core drilled.*
- *Elevation at bottom of exploration, N.G.V.D.*

0.0 MLW = -1.06 N.G.V.D.

REVISION	DATE	DESCRIPTION	BY

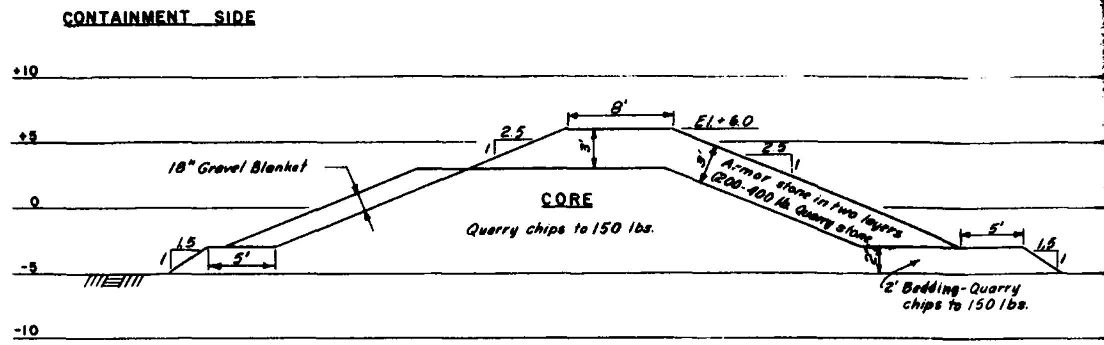
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY
DR. BY
CK. BY

**LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GRAPHIC BORING AND PROBING LOGS
PROPOSED BLACK LEDGE SITE
GROTON, CT.**

GEOTECH. ENG. BR.	SCALE: AS SHOWN
PLATE 7	DATE: APRIL 1982

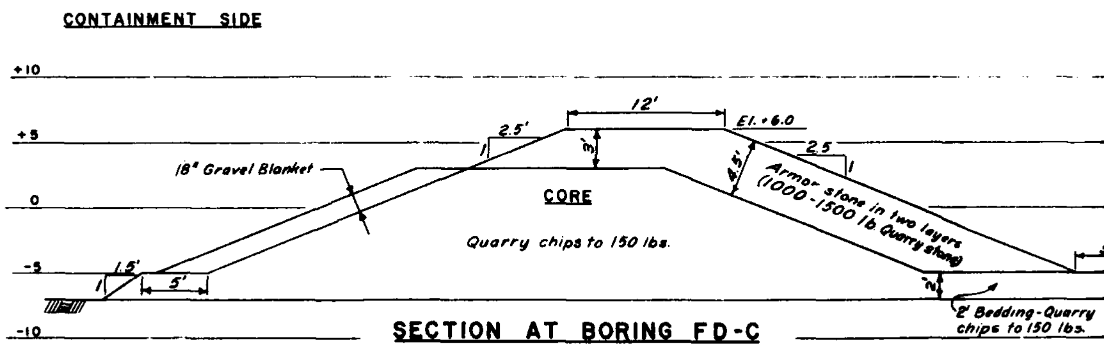
CORPS OF ENGINEERS



SECTION AT BORING FD-B

SCALE: 1" = 5'

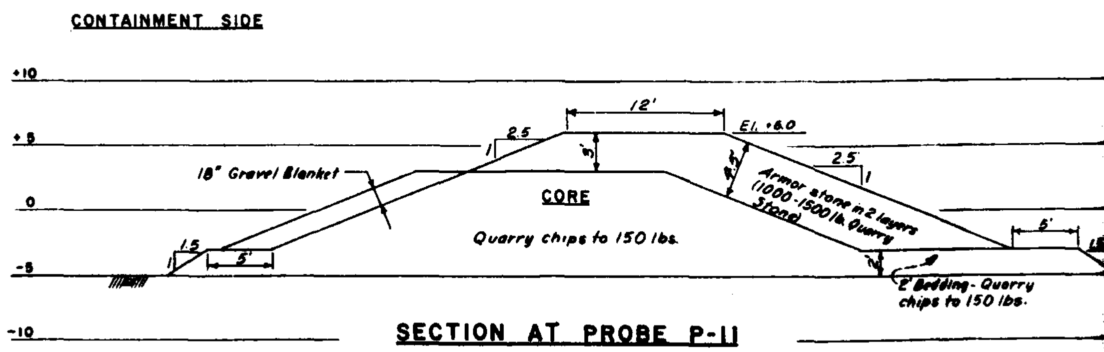
TYPICAL SECTION BORING FD-B TO NORTH SHORE (2000±FT.)



SECTION AT BORING FD-C

SCALE: 1" = 5'

TYPICAL SECTION PROBE P-11 TO BORING FD-B (1900±FT.)



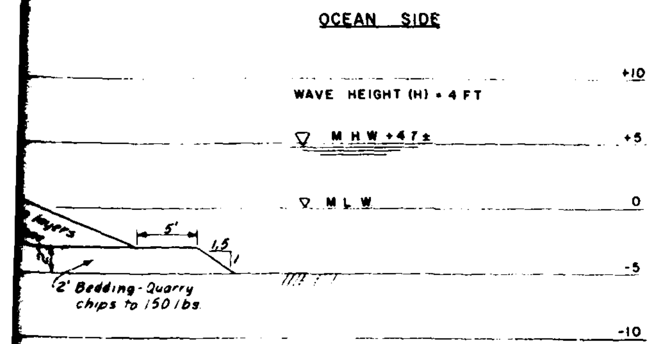
SECTION AT PROBE P-11

SCALE: 1" = 5'

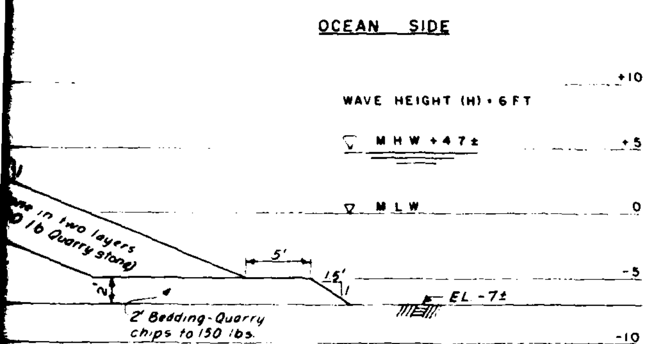
TYPICAL SECTION - WEST SHORE TO PROBE P-11 (1000±FT.)

1

U. S. ARMY

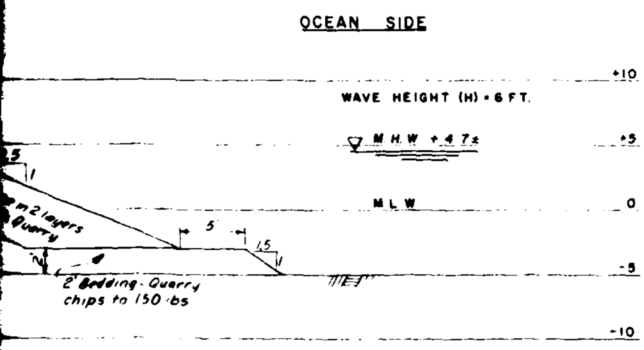


(2000±FT)



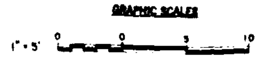
00±FT.)

NOTES
1. For location of typical sections, see Plate 3.
2. Elevations are in feet and tenths and refer to Mean Low Water (M.L.W.)
3. 0.0 M.L.W. = -1.95 National Geodetic Vertical Datum (N.G.V.D.)



(1000±FT)

GRAPHIC SCALES



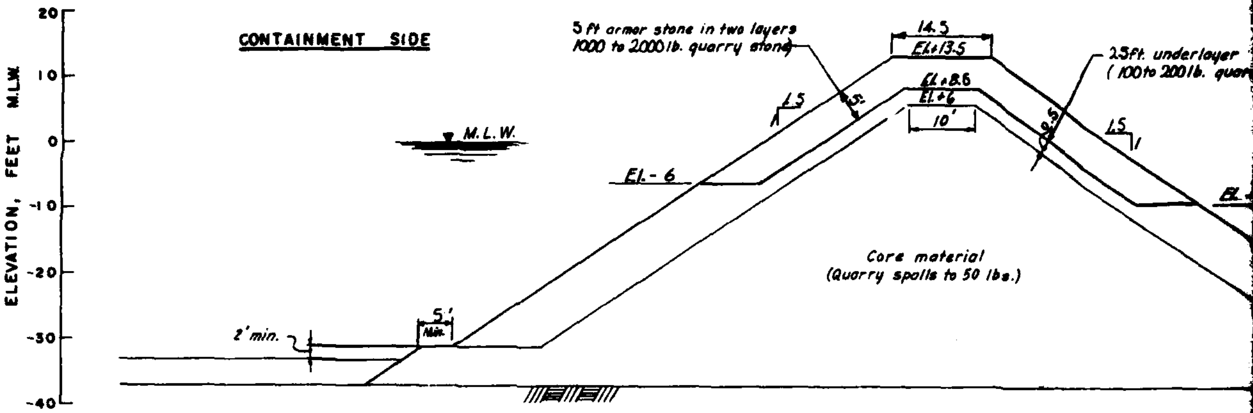
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
TYPICAL CROSS SECTIONS
PROPOSED CLINTON HARBOR SITE
CLINTON, CT.

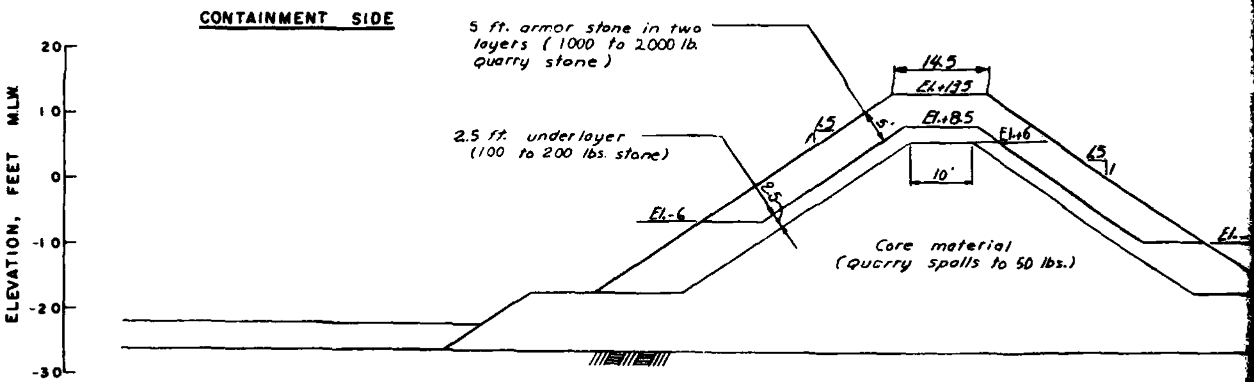
GEOTECH. ENG. BR.
PLATE 8

SCALE: AS SHOWN
DATE: APRIL 1982

CORPS OF ENGINEERS



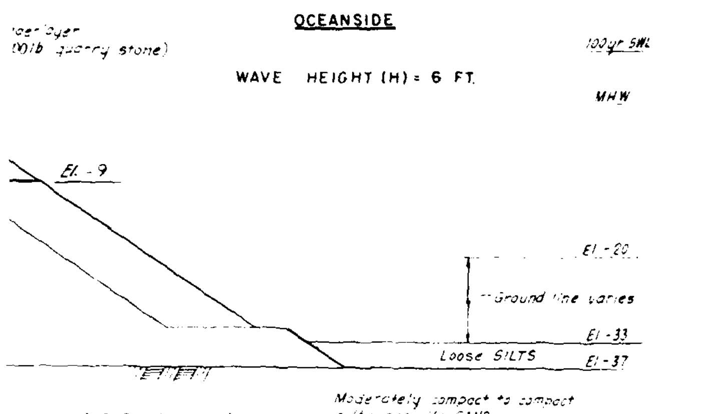
TYPICAL SECTION - BORING FD-A TO PROBE NO. 21



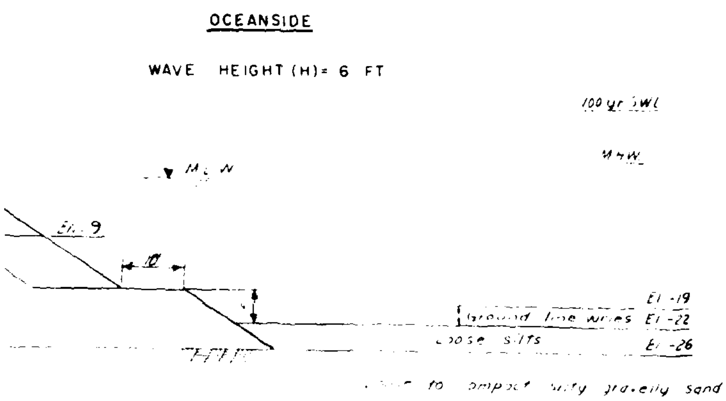
TYPICAL SECTION - PROBE NO. 21 TO POINT "C" (1500

E F G H

U. S. ARMY



). 21 (2,900 FT.)



1500 FT.)

NOTES
1 For locations of typical sections see Plate 4
2 Elevations are in feet and tenths and are referred to Mean Low Water (M.L.W.)
3 0.0 Mean Low Water = -1.05 National Geodetic Vertical Datum (N.G.V.D.)

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY
DR. BY
CK. BY

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
TYPICAL CROSS SECTIONS NO. 1
PROPOSED BLACK LEDGE SITE
GROTON, CT.

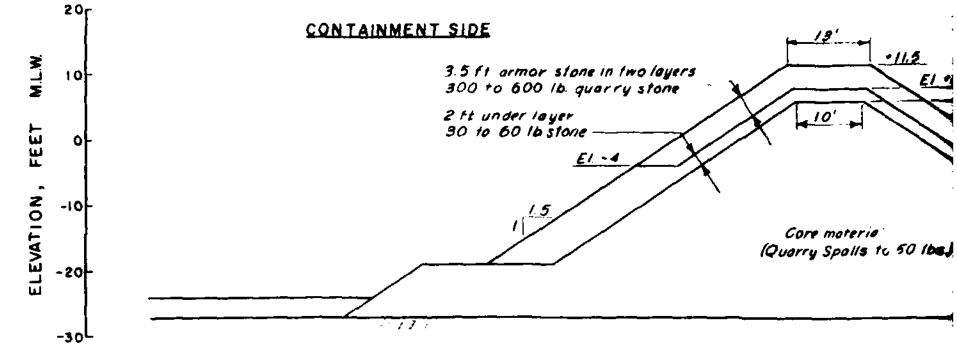
GEOTECH. ENG. BR.
PLATE 9

SCALE: AS SHOWN
DATE: APRIL 1982

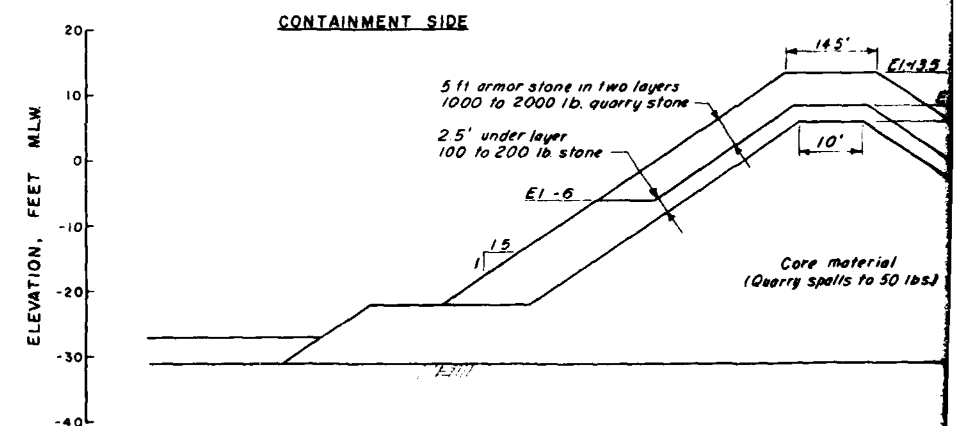
2

CORPS OF ENGINEERS

A B C D

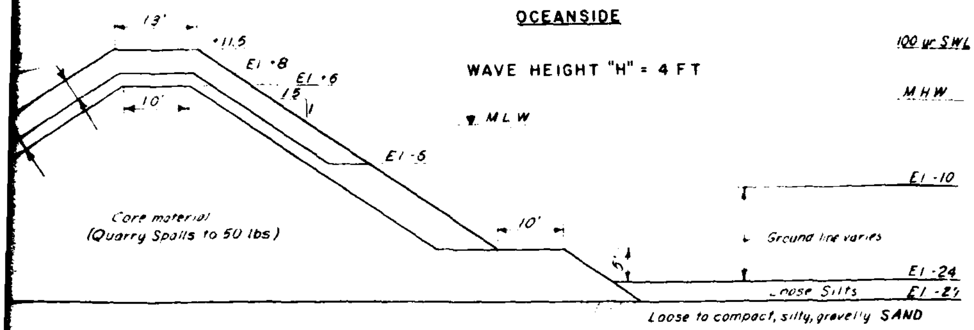


TYPICAL SECTION - BORING FD-

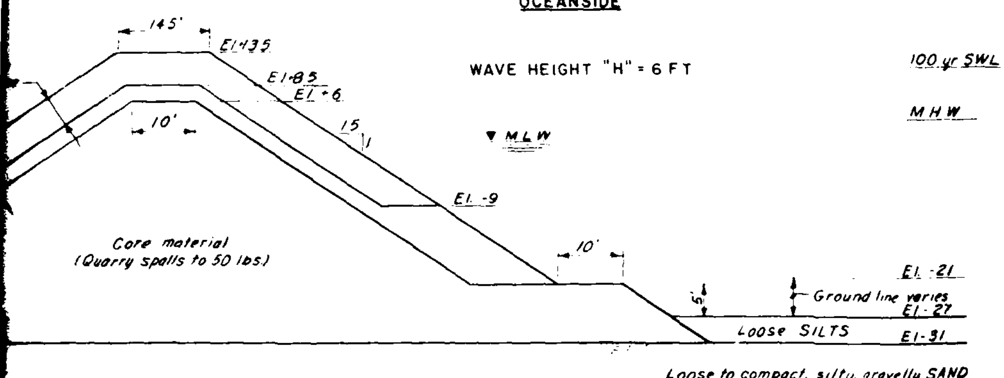


TYPICAL SECTION - POINT "B"

D E F G H U. S. ARMY



TION - BORING FD-A TO POINT "B" (3200 FT)



NOTES
1. For location of Typical Sections see Plate 4
2. Elevations are in feet and tenths and are referred to Mean Low Water Datum (MLW)
3. 0.0 MLW = -1.05 National Geodetic Vertical Datum (NGVD)

CTION - POINT "B" TO POINT "C" (1650 FT.)

GRAPHIC SCALES
1" = 10' 10 0 10 20

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
TYPICAL CROSS SECTIONS NO. 2
PROPOSED BLACK LEDGE SITE
GROTON, CT.

DES. BY:
DR. BY:
CK. BY:

GEOTECH. ENG. BR.
PLATE 10

SCALE: AS SHOWN
DATE: APRIL 1982

1 2 3 4 5 6 7 8

2

LONG ISLAND SOUND

DREDGE MATERIAL CONTAINMENT STUDY

SITE SCREENING REPORT

US Army Corps of Engineers
New England Division
Engineering Division
Geotechnical Engineering Branch
Waltham, Massachusetts 02254
November 1982

LONG ISLAND SOUND

DREDGE MATERIAL CONTAINMENT STUDY

SITE SCREENING REPORT

GEOTECHNICAL ENGINEERING BRANCH

NOVEMBER 1982

LONG ISLAND SOUND

DREDGE MATERIAL CONTAINMENT STUDY

SITE SCREENING REPORT

GEOTECHNICAL ENGINEERING BRANCH

NOVEMBER 1982

SKETCHES

PLATES

LONG ISLAND SOUND

DREDGE MATERIAL CONTAINMENT STUDY

SITE SCREENING REPORT

GEOTECHNICAL ENGINEERING BRANCH

NOVEMBER 1982

1. Regional Topography. The coastal areas of Connecticut and eastern New York lie within the Seaboard Lowland section of the New England physiographic province. The lowland, a seaward-sloping region, is generally characterized by low hills and plains. It is lower and smoother than the adjacent upland and this change in topography usually occurs between elevations 400 feet NGVD[1] and 500 feet NGVD. The lowland in the Connecticut-New York area extends inland up to 20 miles.

The topography of the coastal area is primarily bedrock-controlled; however, differential erosion of the bedrock during the early and late Wisconsin glacial periods has extensively modified the pre-existing features. Recent events, including alluvial deposition and relative sea-level rise, have also altered the topography.

2. Regional Geology. The lowland area encompassing the five sites is underlain primarily by early to mid-Paleozoic igneous and metamorphic rocks. The igneous rocks consist mainly of granite and diabase, with smaller occurrences of tonalite and quartz monzonite. Pegmatite bodies are locally present. The metamorphic rocks consist primarily of gneiss, granite gneiss, schist, and amphibolite.

Bedrock in the area is covered by glacial till and glacially-deposited, roughly-stratified sand and gravel. In some areas along the coast, the glacial deposits are overlain by a recent depositional sequence of lagoonal silt, peat and organic silt, and beach sand and gravel. Recent alluvial deposits of sand, silt, and gravel are found along river valleys.

3. Seismicity. The lowland area of Connecticut and the small area of New York are located within Zone 1 of the seismic zone map of the United States. This is a modification of the seismic risk map developed by the Environmental Science Administration and the Coast and Geodetic Survey and it is contained in Engineering Regulation 1110-2-1806 dated 30 April 1977. In accordance with this directive, a coefficient of 0.025 g is recommended for use in any preliminary evaluation of the seismic stability of the structures. A detailed seismic analysis will be made as necessary during final design efforts.

[1]National Geodetic Vertical Datum is defined as the mean sea-level of 1929.

4. Available Geotechnical Information. Field reconnaissance trips were made to the five sites in order to describe and photograph existing conditions. The Penfield Shoal, Milford Harbor, and Yellow Mill Channel sites were visited in August 1982 and the Mamaroneck Harbor and Thames River sites were visited in September 1982.

No subsurface explorations were performed for this level of study. The Connecticut State Highway Department provided boring and construction information for the Greenwich-Killingly Expressway Bridge over Yellow Mill Channel and for the Gold Star Memorial Bridge over the Thames River.

5. Site Geology.

a. Milford Harbor.

(1) Topography. The Milford Area is part of a coastal belt of dissected, hilly country that extends across Connecticut. Where this surface intersects Long IslandSound, an irregular shoreline results, with the points and headlands separated by coves. The gulf, which is the submerged mouth of the Wepawaug and Indian Rivers, is a typical large indentation in the shoreline.

The irregular shoreline and the presence of islands, such as Charles Island, suggest that recent relative sea-level rise and its associated deposition have been the main factors in modifying the original bedrock topography. Except in the larger valleys, the cover of glacial drift is generally so thin that it does not mask the forms of the bedrock hills. Only locally, has the accumulation of glacial drift significantly increased the relief of individual hills.

Onshore elevations range from tide level to over 150 feet NGVD, but the majority of the coastal area lies under elevation 30 feet NGVD. Minimum off-shore elevation in the project area is -6 feet MLW[1].

(2) Surficial Geology. In general, Pleistocene-age glacial deposits are dominant in the Milford area. Recent deposits are found in coastal and low-lying areas. The distribution of surficial material is depicted on Plate 1 "Surficial Geology Maps".

Glacial till is a compact, unsorted, non-stratified mixture of rock particles of all sizes. The till, deposited directly by glacial ice, blankets the bedrock surface. Its composition is quite variable, depending upon the bedrock from which it was derived. Due to the irregular bedrock surface, the thickness of the till varies from place to place; however, its average thickness is between 8 and 15 feet. The till is generally exposed in areas of higher elevations, such as Western Milford, Knobb Hill, and Bryan Hill.

[1]Mean Low Water (MLW) is approximately 1.7 feet less than NGVD at Milford, although the difference has not been precisely determined.

There are two primary types of stratified glacial deposits in the Milford area: ice-contact stratified drift and outwash. Ice-contact stratified drift deposits are sediments deposited in streams and other bodies of water in immediate contact with melting glacial ice. These deposits consist of sand, gravel, silt, and clay and they tend to be deformed and poorly sorted with abrupt changes in grain size. They grade down-valley into outwash deposits. The outwash deposits are sediments deposited by streams beyond the glacier, free from any influence of buried ice. They consist of sand and gravel, with characteristic cut-and-fill stratification. These stratified deposits overlie the till. Ice-contact stratified drift is exposed to the west and northeast of Milford, while outwash deposits are common in the Milford and Fort Trumbull areas.

In addition to glacially-derived overburden, there is an extensive amount of recent sediments, consisting mainly of swamp and shoreline deposits. The swamp deposits resulted from recent sea-level rise submerging the lower parts of valleys causing an extensive tidal environment conducive for the growth of specialized plants. These deposits consist of silt, sand, and clay mixed with organic matter. Large swamps are located behind Silver Beach and along Gulf Pond and Milford Harbor. Virtually all the coastline in the area is fringed with beaches consisting of sand, gravel, or a mixture of both. The grain size of these sediments reflects the character of the materials locally exposed to the surf.

Artificial fill is mentioned because of its large areal extent. Major filled areas include the coastal area along Milford Harbor and the swampy area behind Silver Beach. The composition of the fill is quite variable from site to site, depending on the source; however, sand and gravel tend to be the major components.

(3) Bedrock Geology. The bedrock underlying the Milford area is part of a sequence of early to middle-Paleozoic, metasedimentary and metavolcanic rocks. In middle to late-Devonian time, the rocks were tightly folded, subjected to igneous intrusions, and progressively metamorphosed. The principal structure is the Wepawaug Syncline, a complex syncline trending north-northeast. The bedrock geology map of the area is presented on Plate 2, "Bedrock Geology Maps".

The Ordovician Orange Formation is the oldest member present. The Oronoque Member is a paragneiss, while the Derby Hill member is a chlorite-muscovite schist grading into a phyllite. Overlying the Derby Hill Schist is the Maltby Lakes Volcanics. East of the Wepawaug River, greenschist and low-grade amphibolite predominate. West of the Wepawaug River, higher-grade amphibolite is found. The late-Ordovician Allingtown metadiabase, consisting of metadiabase grading into amphibolite, overlies the Maltby Hill sequence. Unconformably overlying the Allingtown metadiabase is the Silurian to Devonian Wepawaug Schist, consisting of phyllitic schist and paragneiss.

b. Yellow Mill Channel.

(1) Topography. The topography of the Bridgeport area is similar to that of the Milford area. Glaciation has somewhat modified the original bedrock features. Recent relative sea-level rise has extensively changed the coastal region, resulting in large swamp deposits and an irregular shoreline. Elevations range from tide level to over 75 feet NGVD at Mill Hill, with the majority of the coastal area lying under 25 feet NGVD. The minimum natural off-shore is roughly -10 feet MLW [1], although Bridgeport Channel has been dredged to -32 feet MLW.

(2) Surficial Geology. In general, Pleistocene-age glacial deposits dominate the surficial geology of the area. Recent deposits are found in coastal and low-lying areas. The generalized surficial geology map is presented on Plate 1.

Glacial till overlies bedrock and its composition is quite variable. Due to the irregular bedrock surface, the thickness of the till varies, although it is usually under 20 feet thick. The till is generally exposed in areas of higher elevations, such as Golden Hill and Milford, overlie the till. These granular deposits, which form the major aquifer in the Bridgeport area, are up to 120 feet thick. They are exposed throughout lower-lying regions of Bridgeport, East Bridgeport, and Newfield.

Recent shoreline deposits, primarily sand and gravel, are found at Pleasure Beach and Long Beach. Recent swamp deposits are found at Great Meadows and other low-lying, tidal areas. Extensive tracts have been artificially filled.

(3) Bedrock Geology. The bedrock underlying the Bridgeport area is part of a sequence of middle and upper-Ordovician, metasedimentary and metavolcanic rocks. In middle to late-Devonian time, the rocks were tightly folded, subjected to igneous intrusions, and progressively metamorphosed. Episodes of faulting and igenous activity also occurred during the Permian and Jurassic periods. The principal structure is the Bridgeport Syncline, a complex, overturned syncline trending northeast. The bedrock geology map of the area is presented on Plate 2.

The Oronoque and Derby Hill members of the Orange Formation are the oldest rocks in the area. Overlying the Orange Formation are the rocks of the Hartland group, consisting locally of the Cooks Pond Schist, the Southington Mountain Formation and the Prospect Formation. The Southington Mountain Formation consists primarily of an interlayered mica-quartz schist and a biotite gneiss. The youngest unit present is the Prospect Formation. Its Pumpkin Ground member is typically a biotite-quartz-feldspar gneiss with minor interlayered schist and quartzite. The Beardsley Gneiss Member is an epidote-biotite-hornblende-quartz feldspar gneiss with associated pegmatite zones. The upper Golden Hill Schist member is a garnet-feldspar-mica-quartz schist with minor gneiss and quartzite.

[1] Mean low water is approximately 2.9 feet lower than NGVD at Bridgeport.

c. Thames River.

(1) Topography. The topography of the Thames River-New London area is primarily controlled by bedrock, although glaciation has extensively modified the original topography. The region is characterized by hills corresponding to exposed bedrock and mounds of glacial till. Maximum elevations are approximately 170 feet NGVD with the majority of the area between elevations 50 feet and 125 feet NGVD. Minimum offshore elevation in the project area is approximately -18 feet MLW[1], although 20 to 30 foot depths are encountered in some areas of the river.

(2) Surficial Geology. In general, Pleistocene-age glacial deposits dominate the area, with recent deposits restricted to local coastal and low-lying areas. Overburden cover in the area is quite variable, ranging between no cover to over 100 feet in thickness. The distribution of surficial materials is shown on Plate 2.

Glacial till in the area is generally a compact, sandy and gravelly till grading into a looser, sandy, gravelly, and bouldery till. It is exposed at the surface over most of the project area. Stratified drift deposits, primarily ice-channel or valley-fill deposits and kame terraces, are found to the west of the project site and along the river near the Coast Guard Academy and the east abutment of the I-95 Gold Star Memorial Bridge.

(3) Bedrock Geology. The bedrock underlying the New London area is part of a sequence of early Paleozoic metamorphic rocks intruded by middle to late-Paleozoic igneous rocks. Structurally, the area is characterized by a series of complex, overturned folds trending west-northwest. In theproject area, the rocks are on an overturned limb, giving the impression that older rocks overlie younger ones. The bedrock geology map of the area is shown on Plate 2.

The Plainfield Formation is a Cambro-Ordovician unit consisting of biotitic feldspathic quartzite and biotite-feldspar-quartz schist and gneiss. Overlying the Plainfield Formation is the Mamacoke Formation, a Cambro-Ordovician unit with two primary members. The lower unit is composed of biotite-quartz-plagioclase gneiss with minor schist and amphibolite. The upper member is a layered sequence of biotite-quartz-orthoclase gneiss, calc-silicate gneiss, amphibolite, biotite-quartz-andesine gneiss, and garnet-quartz-sillimanite-biotite-andesine gneiss. The New London Gneiss overlies the Mamacoke and has three principal members. The lower unit is a hornblende-biotite-quartz-plagioclase gneiss. The middle unit is a gneissic grandiorite with local quartz monzonite. The upper unit consists of interlayered granodioritic gneiss and amphibolite, with subordinate hornblende-plagioclase gneiss, alaskite, and granite gneiss. The overlying Monson Gneiss is a hornblende-biotite-quartz-plagioclase gneiss with small lenses of alaskite and amphibolite.

[1]Mean low water datum is approximately 1 foot lower than NGVD at New London.

Intruding these rocks are members of the Mississippian Sterling Plutonic Group. The biotite granite gneiss and the Alaskite gneiss, which consists of granite and granite gneiss, are the rocks locally present.

d. Penfield Shoal.

(1) Topography. The topography of the Fairfield area is not unlike that of the other areas. Glaciation has modified the original bedrock topography, which was very similar to that found at Yellow Mill Channel. Recent relative sea-level rise has significantly modified the region, resulting in large coastal and swamp deposits and an irregular shoreline. Elevations range from tide level to over 50 feet NGVD at Grover Hill, with the majority of the Fairfield area lying under 20 feet NGVD. The minimum offshore elevation is approximately -18 feet MLW[1].

(2) Surficial Geology. In general, Pleistocene-age glacial deposits dominate the surficial geology of the area. Recent deposits are found along the shoreline and in some low-lying areas. The generalized surficial geology map is presented on Plate 1.

Glacial till overlies bedrock and its composition is quite variable, depending on its source material. The thickness of the till varies, although it is usually under 20 feet thick. It is generally exposed in areas of higher elevations, such as Grover Hill. Stratified drift deposits overlie the till. These aquifer-forming deposits are in excess of 150 feet thick in areas around Fairfield. They are exposed virtually throughout the lower-lying regions:

Recent shoreline deposits, consisting mainly of sand and gravel, are found along the coast, especially at Fairfield Beach. Recent swamp deposits are found in low-lying, tidal areas.

(3) Bedrock Geology. The bedrock underlying the Fairfield area is an extension of the sequence forming the Bridgeport Syncline, as described for the Yellow Mill Channel site. The bedrock geology map of the area is presented on Plate 2.

e. Mamaroneck Harbor.

(1) Topography. The topography of the Mamaroneck area is similar to the topography of the other coastal Long Island Sound sites. Glacial cover in the area is thin, as evidenced by numerous bedrock exposures. Recent relative sea-level rise has resulted in the irregular shoreline. Elevations in the area are generally under 30 feet NGVD. Minimum off-shore elevations in the project area are -20 feet MLW[2].

(2) Surficial Geology. Glacial till, exposed in areas of higher elevation, and stratified drift, exposed in areas of lower elevation, dominate the surficial geology of the area. Recent shoreline and swamp deposits are restricted to coastal and low-lying, tidal areas.

[1]Mean Low Water datum is approximately 2.9 feet lower than NGVD, although the precise difference has not been determined.

[2]Mean Low Water is approximately 3 feet lower than NGVD, although the precise difference has not been determined.

(3) Bedrock Geology. The bedrock underlying the Mamaroneck area is part of a sequence of early Paleozoic igneous and metamorphic rocks consisting primarily of granite, schist, and gneiss.

6. Foundation Conditions. No subsurface explorations were performed specifically for this study at any of the five proposed dredge containment sites. At two sites (Yellow Mill Channel, Thames River) subsurface information, including boring logs, was provided by the Connecticut State Highway Department. The available subsurface information was utilized by the state of Connecticut for the design of bridges that are adjacent to the two proposed sites. In conjunction with specific subsurface information, surficial geology maps, site reconnaissance, and any other available information was used in formulating assumed foundation conditions utilized in the preliminary retention dike designs.

a. Milford Harbor Site. As shown on Sketch MH-1 (proposed Milford Harbor site, Milford, CT). The preliminary retention dike alignment extends approximately 1700 feet south from Burns Point, west 500 feet then north 1500 feet returning to Burns Point.

Based on coastal chart information the ground elevation within the proposed retention dike alignment ranges from mean high water (+3.6 NGVD) at the shoreline to about 6 feet below mean low water (-9.0 NGVD) at the southern most end of the retention dike.

The available subsurface information (site reconnaissance, surficial geology) indicates that in the vicinity of the proposed Milford Harbor site, foundation soils will consist of sands and gravels with some silts.

b. Yellow Mill Channel Site. As shown on Sketch YMC-1, (proposed Yellow Mill Site, Bridgeport, CT) the preliminary retention dike alignment extends across Yellow Mill Channel with an approximate length of 500 feet.

Coastal chart, topographic map and Connecticut Turnpike Bridge design information indicate that the ground elevation along the proposed dike alignment ranges from +10 NGVD along the east and west channel shoreline to as deep as -20 feet NGVD at the center of the channel.

Subsurface information for design of the Greenwich-Killingly Expressway Bridge provided by the Connecticut State Highway Department was utilized in developing the assumed foundation conditions as shown on the typical cross section Sketch YMC-2. The Greenwich-Killingly Bridge is located approximately 600 feet south of the proposed dredge containment site. The location of borings are shown on the Plan of Explorations (selected), Sketch YMC-3. Based on the available boring logs, foundation soils are assumed to consist of from 5 to 30 feet of stiff to very stiff inorganic silt. Standard Penetration Test values for the organic silt and clay were 0 (push) blows per foot and range from 10 to 22 blows per foot in the inorganic silt deposit.

c. Thames River Site. As shown on Sketch TR-1 (proposed Thames River site, New London, CT) the proposed dredge containment site is on the west shore of the Thames River, partially under the westbound route I-95 Bridge.

Available subsurface information provided by the Connecticut State Highway Department as shown on the Plan of Explorations (selected), Sketch TR-2 indicates 26 to 104 feet of very soft organic silt within and adjacent to the proposed retention dike alignment. Standard Penetration Test values range from 0 (push) to 3 blows per foot throughout the 104 feet of organic silt.

The proposed Thames River site is deleted from any further consideration due to the excessive costs that would be related with providing a stable structure on such poor foundation soils.

d. Penfield Shoal Site. As shown on Sketch PS-1, (proposed Penfield Shoal site, Fairfield, CT) the retention dike alignment extends from Shoal Point to the Cows approximately 7,000 feet. One proposed alignment has an average width of approximately 400 feet with the average width of the alternate alignment approximately 1,800 feet.

Based on coastal chart information the ground elevation within the proposed retention dike alignments range from mean high water (3.9 NGVD) at shoal point to -6 mean low water (-8.9 NGVD) at the Cows.

No specific subsurface information is available at the Penfield Shoal site. However, surficial geology maps indicate stratified drift material consisting of sand and gravel with some silt in the general area of Penfield Shoal. The surficial geology information (see Plate 1) in conjunction with field reconnaissance observations indicate that sands and gravels should be encountered within the foundation soils for the proposed retention dike alignments.

e. Mamaroneck Harbor Site. As shown on Sketch MAH-1 (proposed Mamaroneck Harbor site, Mamaroneck, NY). The proposed retention dike alignment is located between Orienta and Delancey Points and is triangular in shape. The approximate retention dike length is 5,000 feet.

Coastal chart and topographic map information indicate that the ground elevation within the proposed containment structure varies between mean high water (+4.3 NGVD) where structure meets the shoreline and around Crab Island to -12 mean low water (-15 NGVD) along the proposed eastern reach of the structure.

No specific subsurface information is available at the Mamaroneck Site. However, visual observation, coastal chart, and topographic map information indicate bedrock outcrops throughout the general area of the proposed dredge containment site.

7. Retention Dike Designs. In accordance with the level of this study many engineering and non-engineering assumptions had to be made to develop a starting point for design. If these preliminary attempts are accepted in light of environmental, economic, social and technical feasibility, more detailed technical information would have to be accumulated for prospective sites to refine dredge containment structure locations, alignments, heights and configurations.

a. Milford Harbor (Typical Dike Cross Section, Sketch MH-2)

(1) Design Considerations.

(a) The selected crest elevation 12.5 feet MLW (9.5 feet NGVD) was based on placing the top of the dike core material above MHW (3.6 feet NGVD) for construction purposes. The selected crest elevation is comparable in height to the adjacent West (Burns Pt.) and East (Long) jetty crest heights (+5 and +9 feet NGVD).

(b) Dike embankment zoning must be in such a way to retain the dredge material suspended sediment in the containment area and prevent migration of embankment materials.

(c) The method of placement will be with conventional earthmoving equipment (dump truck, dozer) rather than barge, providing a less expensive embankment cross section.

(d) Slope protection requirements are dictated by design wave heights (5.5 and 3.0 feet) and overtopping potential. A wave height of 5.5 feet was used in the design of the typical cross section, Sketch MH-2.

(2) Dike Stability. No stability analysis was performed on the embankment slopes of foundation soils. The proposed dike cross section (with 1V to 1½ H side slopes) is assumed to be stable based on adjacent structures (east and west jetty), previous experience and assumed foundation conditions.

(3) Construction Considerations. Hauling of the core material will be by truck from land borrow areas. Placement will be by dumping from the trucks and spreading by bulldozer, starting from shore and progressing outward. The core will be maintained at an elevation of 8 MLW (+5 NGVD) which is about 1 foot above mean high water. For adequate hauling and working space the top of the core will be 15 feet wide. After the dike core is placed, riprap slope protection will be placed by a crane operating from the top of the core. Source of slope protection will be quarry rock hauled by truck overland from quarries within an estimated 30 mile radius of the site.

(4) Slope Protection. Stone sizes for the slope protection on the dike were determined from criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection Manual and Coastal Engineering Note TN 111-1, Riprap Revetment Design.

b. Yellow Mill Channel (Typical Dike Cross Section, Sketch YMC-2)

(1) Design Considerations

(a) The top of dike elevation of +10 feet NGVD was selected based on the existing ground elevation on the east and west side of the channel.

(b) Due to the location of the site and assumed foundation conditions (based on borings 600 feet south of the site), the selected cross section will be constructed of random fill which will displace the very weak foundation soils.

(c) The method of construction will be with conventional earth-moving equipment (dump truck, dozer).

(d) The protected location of the proposed site allows for minimal slope protection (1½ feet graded stone protection).

(2) Dike Stability. No stability analysis was performed on the embankment slopes or foundation soils. The proposed dike cross section with 1 vertical to 3 horizontal is assumed to be stable after the initial displacement of foundation soils induced by the load of the embankment soils.

(3) Construction Considerations. Hauling of the core material will be by truck from land borrow areas. Placement will be by dumping from the trucks and spreading by bulldozer, starting from shore and progressing outward. After the dike embankment is placed, riprap slope protection will be placed by crane operating from top of the dike. Source of slope protection will be quarry rock hauled by truck overland from quarries within an estimated 30 mile radius of the site.

(4) Slope Protection. Stone sizes for the graded slope protection on the channel side of the dike were determined from the criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection Manual and Coastal Engineering Note TN 111-1, Riprap Revetment Design. Slope protection was designed for a 2 foot wave height.

c. Thames River. The proposed Thames River site was deleted from consideration due to very poor foundation conditions.

d. Penfield Shoal.

(1) Design Considerations.

(a) The selected crest elevation for the proposed retention dike, 13.5 feet MLW (10.5 feet NGVD) was based on constructing the top of the core zone above MHW (3.9 NGVD) for construction purposes. The selected crest elevation of 10.5 feet NGVD is within the elevation range suggested by the town of Fairfield, CT.

(b) Dike embankment zoning must be in such a way to retain the dredge material suspended sediment within the containment area and prevent migration of embankment materials.

(c) The method of construction will be with conventional earth-moving equipment (dump truck, dozer).

(d) Slope protection requirements are dictated by design wave heights (6.5 and 5.0 feet) and overtopping potential.

(2) Dike Stability. No stability analysis was performed on the embankment slopes of foundation soils. The proposed dike cross section (1V to 1½ H side slopes) is assumed to be stable based on adjacent structures (groins), previous experience, and assumed foundation conditions.

(3) Construction Considerations. Hauling of the core material will be by truck from land borrow areas. Placement will be by dumping from the trucks and spreading by bull dozer, starting from shore and progressing outward. The core will be maintained at an elevation of 8 MLW (+5 feet NGVD) which is about 1 foot above mean high water. For adequate hauling and working space the top of the core will be 15 feet wide. After the dike core is placed, riprap slope protection will be placed by crane operating from the top of the core. Source of of slope protection will be quarry rock hauled by truck overland from quarries with an estimated 30 mile radius of the site.

(4) Slope Protection. Stone sizes for the slope protection on the dike were determined from criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection manual and Coastal Engineering Note TN 111-1, Riprap Revetment Design.

e. Mamaroneck Harbor (Typical Dike Cross Section, Sketch MAH-2)

(1) Design Considerations.

(a) The selected crest elevation of 14 feet MLW (11 feet NGVD) was based on placing the top of the dike core material above MHW (4.3 feet NGVD) for construction purposes.

(b) Dike embankment zoning must be in such a way to retain the dredge material suspended sediment in the containment area and prevent migration of embankment materials.

(c) The method of placement will be with conventional earth-moving equipment (dump truck, dozer).

(d) Slope protection requirements are dictated by design wave heights (7.0, 5.0 and 3.0 feet) and overtopping potential. For the Typical Cross Section, Sketch MAH-2, a design wave of 7.0 feet was used.

(2) Dike Stability. No stability analysis was performed on the embankment slopes of foundation soils. The proposed dike cross section with (1 V to 1½ H side slopes) is assumed to be stable based on previous experience and assumed foundation conditions.

(3) Construction Considerations. Hauling of the core material will be by truck from land borrow areas. Placement will be by truck from land borrow areas. Placement will be by dumping from trucks and spreading by bulldozer, starting from shore and progressing outward. The core will be maintained at an elevation of 8 MLW (+5 NGVD) which is about 1 foot above mean high water. For adequate hauling and working space the top of the core will be 15 feet wide. After the dike core is placed, riprap slope protection will be placed by a crane operating from the top of the core. Source of slope protection will be quarry rock hauled by truck overland from quarries with an estimated 30 mile radius of the site.

(4) Slope Protection. Stone sizes for the slope protection on the dike were determined from criteria set forth in the Coastal Engineering Research Center (CERC) Shore Protection Manual and Coastal Engineering Note TN 111-1, Riprap Revetment Design.

8. Availability of Construction Materials. Preliminary designs indicate that the containment facilities will be constructed primarily from rock, with small quantities of gravel required for filter layers.

Rock is available from large commercial suppliers in Woodbury, Bridgeport, North Branford, and other locations in Connecticut. Filter material is available from commercial gravel suppliers in Shelton, Devon and Milford, as well as crushed stone from the rock sources cited above. In general, construction materials are available within a 30 mile radius of each project location.

9. Conclusions and Recommendations.

a. Siting of proposed dredge containment facilities should pass minimum economic, environmental, social and technical criteria prior to any technical evaluation of a site.

b. Dredge containment facilities should be planned in conjunction and as part of other coastal projects such as breakwaters or other shore protection systems to the benefit of both facilities.

c. Dredge containment facilities can not be optimized without the availability of detailed survey and subsurface information for a site.

d. To improve economic and technical feasibility of dredge containment facilities, proposed alignments should take advantage of topography and foundation conditions of area (minimizing construction requirements and maximizing containment volume).

e. Retention dike construction operating from land and utilizing conventional earth-moving equipment is at least 30 to 50% less expensive than deep water operations using barges.

f. Recommendation is made that the Thames River Site, New London, CT be deleted from further consideration as a dredge containment site due to the extremely poor foundation conditions.

g. The Milford Harbor Site appears to be a technically feasible site. However, detailed survey, and subsurface investigation are required to optimize the proposed dike alignment and cross section. Social acceptance of the site is questionable (especially construction operations).

h. The Yellow Mill Channel Site appears to be a good economical and technically feasible site. Continuation of the interior drainage system (72 inch RCP) through or around the proposed containment facility will have to be addressed. Detailed hydrologic study, survey and subsurface investigation will have to be completed prior to any final design.

i. As result of this preliminary study the Penfield Shoal Site (alternate alignment) appears to be an exceptional site. Assumptions such as ground elevations and subsurface conditions will have to be verified prior to any final design.

j. The proposed Mamaroneck Harbor Site does not appear to be economically feasible. As result of this preliminary study the cost per cubic yard of containment is estimated to be high. Social acceptance of this site is also questionable.

k. Recommendation is made that if any of the proposed dredge containment sites are to be studied further or considered for design that detailed field survey and subsurface investigations be conducted.

LONG ISLAND SOUND

DREDGED MATERIAL CONTAINMENT STUDY

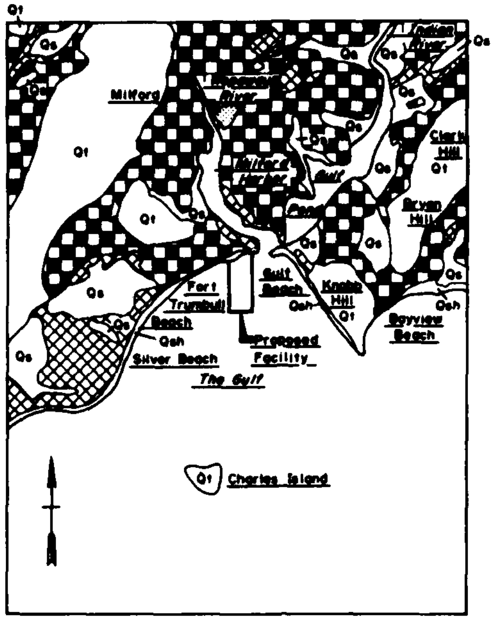
PRELIMINARY ESTIMATE OF DREDGED MATERIAL CONTAINMENT CONSTRUCTION COST AND CONTAINMENT CAPACITY

SUMMARY

SITE	APPROXIMATE DIKE LENGTH	ESTIMATED CAPACITY	ESTIMATED CONSTRUCTION COST
Milford Hbr. Site	4,000 Ft$\pm$	400,000 yd^3	$2,300,000
Yellow Mill Site	500 Ft$\pm$	350,000 yd^3	420,000*
Thames River Site	Deleted from study due to very poor foundation conditions.		
Penfield Shoal Site	15,000 Ft$\pm$	1,000,000 yd^3	8,100,000
Penfield Shoal Alt.	16,000 Ft$\pm$	4,300,000 yd^3	8,700,000
Mamaroneck Hbr. Site	5,000 Ft$\pm$	500,000 yd^3	4,100,000

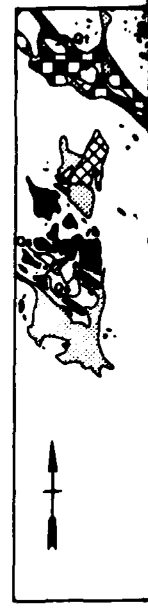
*In addition to the $420,000 retention dike cost, an estimated $1,000,000 must be added for continuation of the 72-inch diameter surface drainage pipe through or around the proposed dredged material containment site, 2,300 feet in length.

The above preliminary estimates of dredged material containment construction costs and containment capacities are "preliminary" and should be used accordingly.

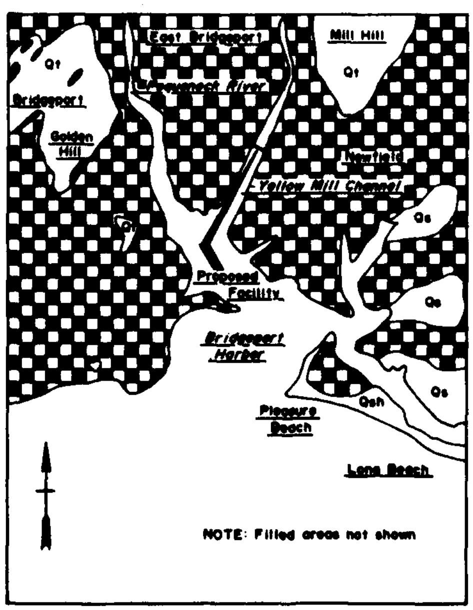


SURFICIAL GEOLOGY MAP-MILFORD HARBOR SITE, CT.

SCALE = 1 : 24,000



SURFICIAL GEOLOG



SURFICIAL GEOLOGY MAP - YELLOW MILL CHANNEL SITE, CT.

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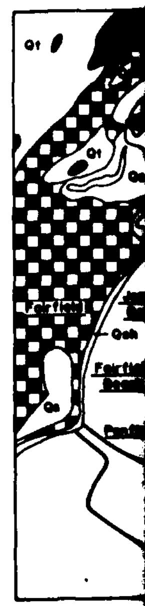
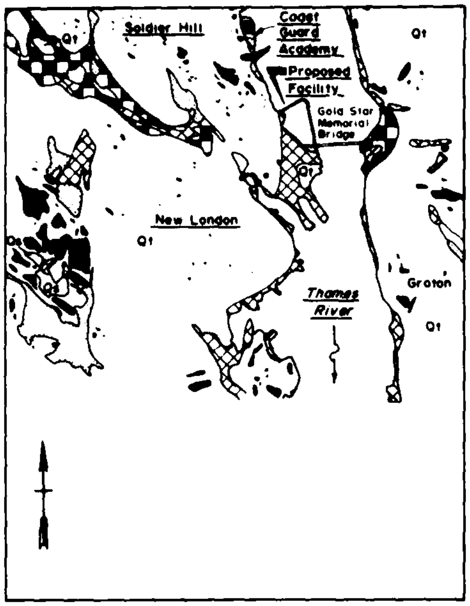
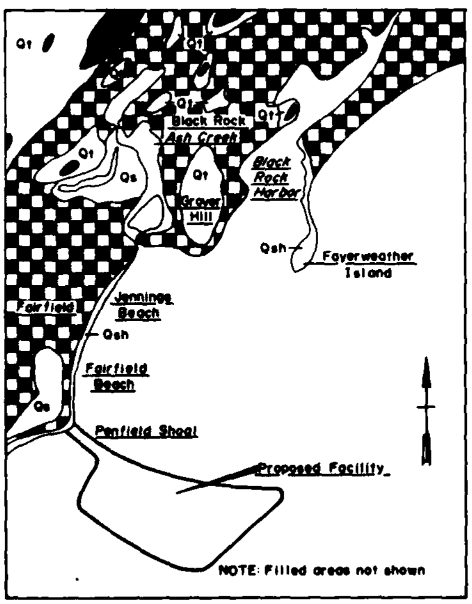


SURFICIAL GEOLO



SURFICIAL GEOLOGY MAP - THAMES RIVER SITE, CT.

SCALE • 1 : 24,000



SURFICIAL GEOLOGY MAP - PENFIELD SHOAL SITE, CT.

SCALE • 1 : 24,000

LEGEND

Recent

Qsh — Shoreline deposits; primarily sand and gravel deposited by waves and wind.

Qs — Swamp deposits; mainly sand, silt, and organic material.

Alluvial deposits; sand, silt, and gravel deposited in channels and floodplains.

Pleistocene

Stratified drift; primarily sand and gravel with some silt deposited by glacial meltwater as kames, kame terraces, and outwash plains.

Qt — Till (ground moraine); mixture of clay, silt, sand, gravel, and boulders deposited directly by glaciers.

Areas of bedrock outcrops.

Artificially - filled areas

Geologic contact, approximately located

GRAPHIC SCALE

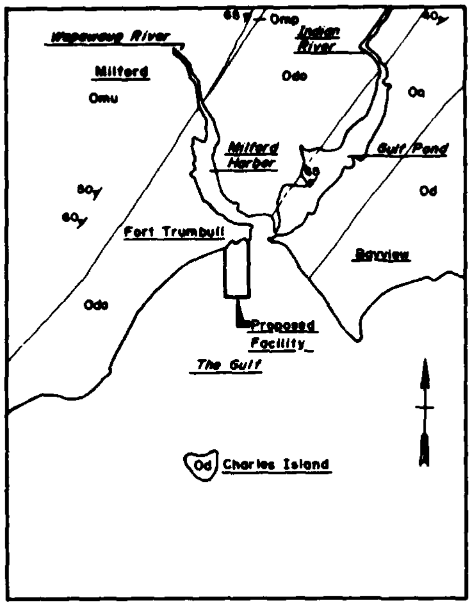
1 : 24,000 (1 in = 2,000 Ft)   2000'   0   2000'   4000'

NOTE:
Surficial geology of Mamaroneck area not shown.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

E. Brickman, DES. BY.	LONG ISLAND SOUND DREDGE MATERIAL CONTAINMENT STUDY
S.W. Kelley, DR. BY.	SURFICIAL GEOLOGY MAPS
CK. BY.	
GEOTECH. ENG. BR.	SCALE: 1:24,000
PLATE 1	DATE: 7 Oct. 82

2

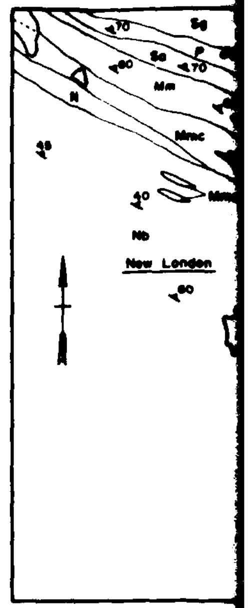


LEGEND

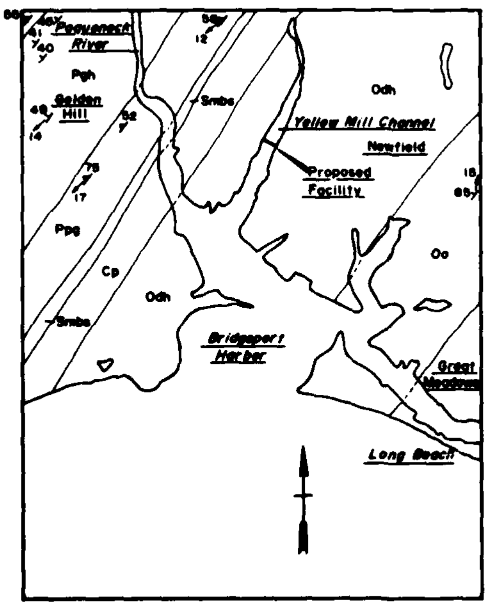
Oa	Allingtown Metadiabase
	Maltby Lakes Volcanics
Omu	Greenschist And Amphibolite
Omp	Schist
	Orange Formation
Od	Derby Hill Member
Odo	Oronoque Member

BEDROCK GEOLOGY MAP - MILFORD HARBOR SITE, CT.

SCALE = 1 : 24,000



BEDROCK GEOL

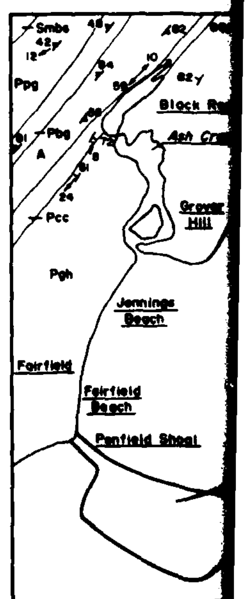


LEGEND

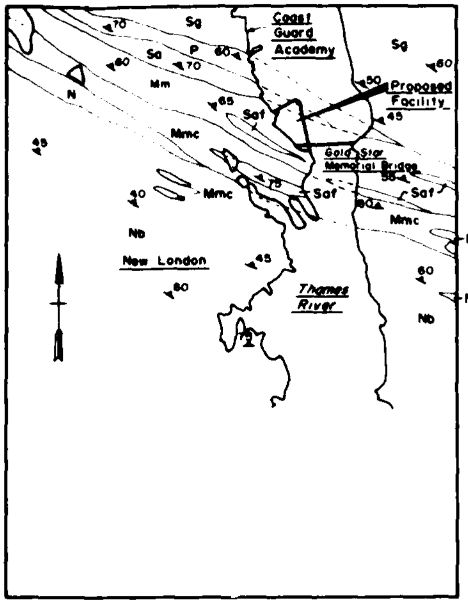
A	Ansonia Gneiss
	Prospect Formation
Pgh	Golden Hill Schist
Ppg	Pumpkin Ground Member
Smbs	Southington Mountain Formation
Cp	Cooks Pond Schist
	Orange Formation
Odh	Derby Hill Member
Oo	Oronoque Member

BEDROCK GEOLOGY MAP - YELLOW MILL CHANNEL SITE, CT.

SCALE = 1 : 24,000



BEDROCK GEOL



LEGEND

Sterling Plutonic Group

Sa	Alaskite Granite Gneiss
Saf	Alaskite Granite
Sg	Biotite Granite Gneiss

New London Gneiss

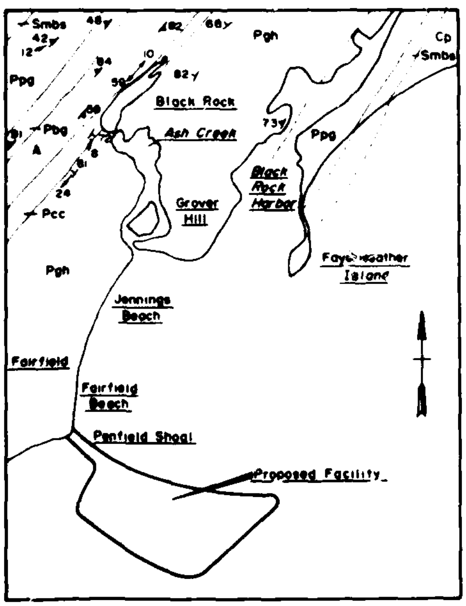
N	Gneiss And Amphibolite
Nb	Granodiorite And Quartz Monzonite
Nh	Gneiss

Mamacoke Formation

Mmc	Gneiss And Amphibolite
Mm	Gneiss
P	Plainfield Formation

BEDROCK GEOLOGY MAP - THAMES RIVER SITE, CT.

SCALE • 1 24,000



LEGEND

A	Ansonia Gneiss

Prospect Formation

Pcc	Calcareous Member
Pgh	Golden Hill Schist
Pbg	Beardsley Gneiss Member
Ppg	Pumpkin Ground Member
Smbs	Southington Mountain Formation
Cp	Cooks Pond Schist

BEDROCK GEOLOGY MAP-PENFIELD SHOAL SITE, CT.

SCALE • 1 24,000

GENERAL LEGEND

Approximate Geologic Contact

Submerged Geologic Contact

44 Strike And Dip Of Bedding

34 Strike And Dip Of Foliation

12 Direction And Plunge Of Mineral Lineation

GRAPHIC SCALE

1 24,000 (1 in = 2000 Ft) 2000 0 2000 4000

NOTES

1 Refer to text for detailed geologic descriptions
2 Bedrock geology of Mamaroneck not shown

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

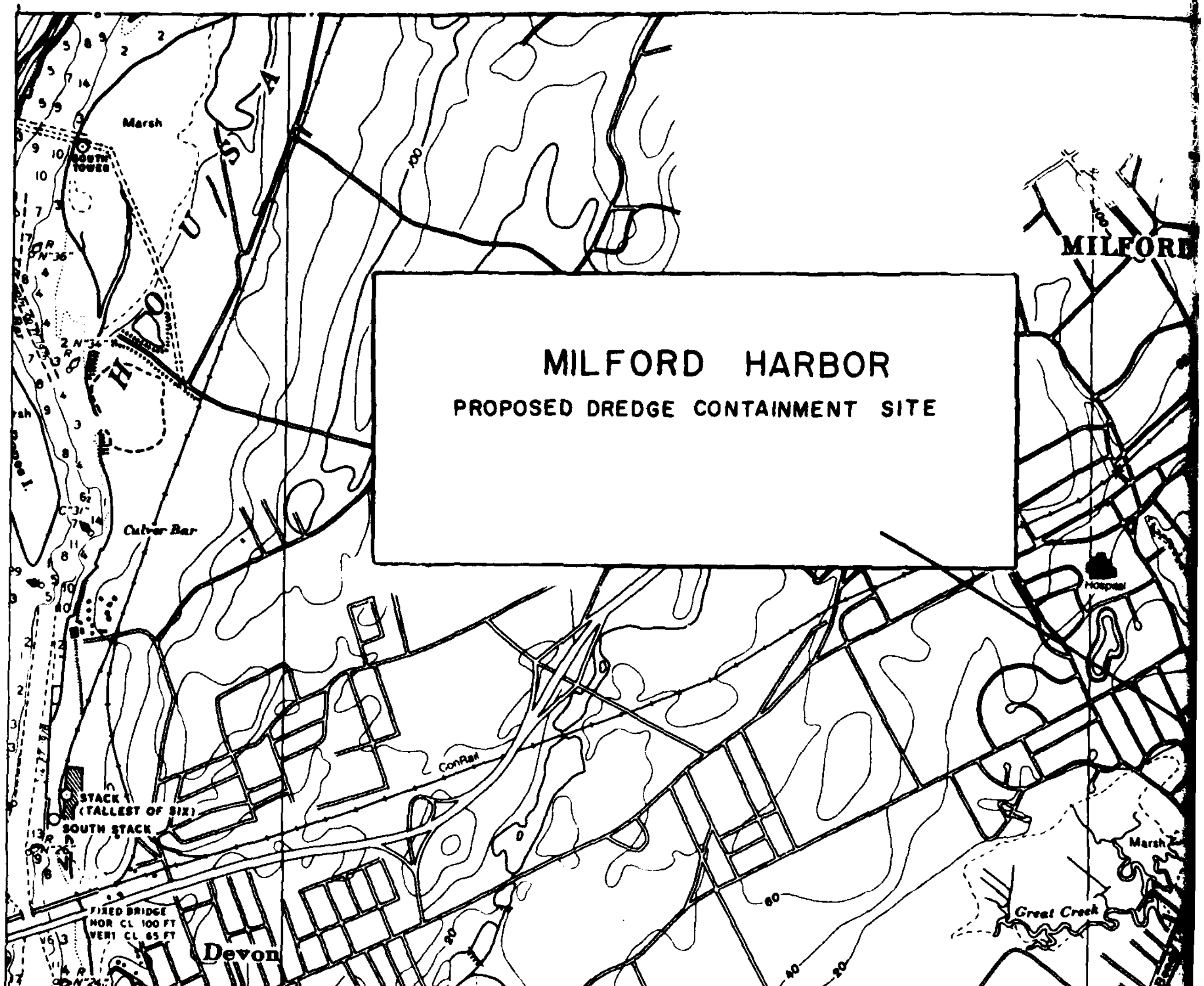
LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
BEDROCK GEOLOGY MAPS

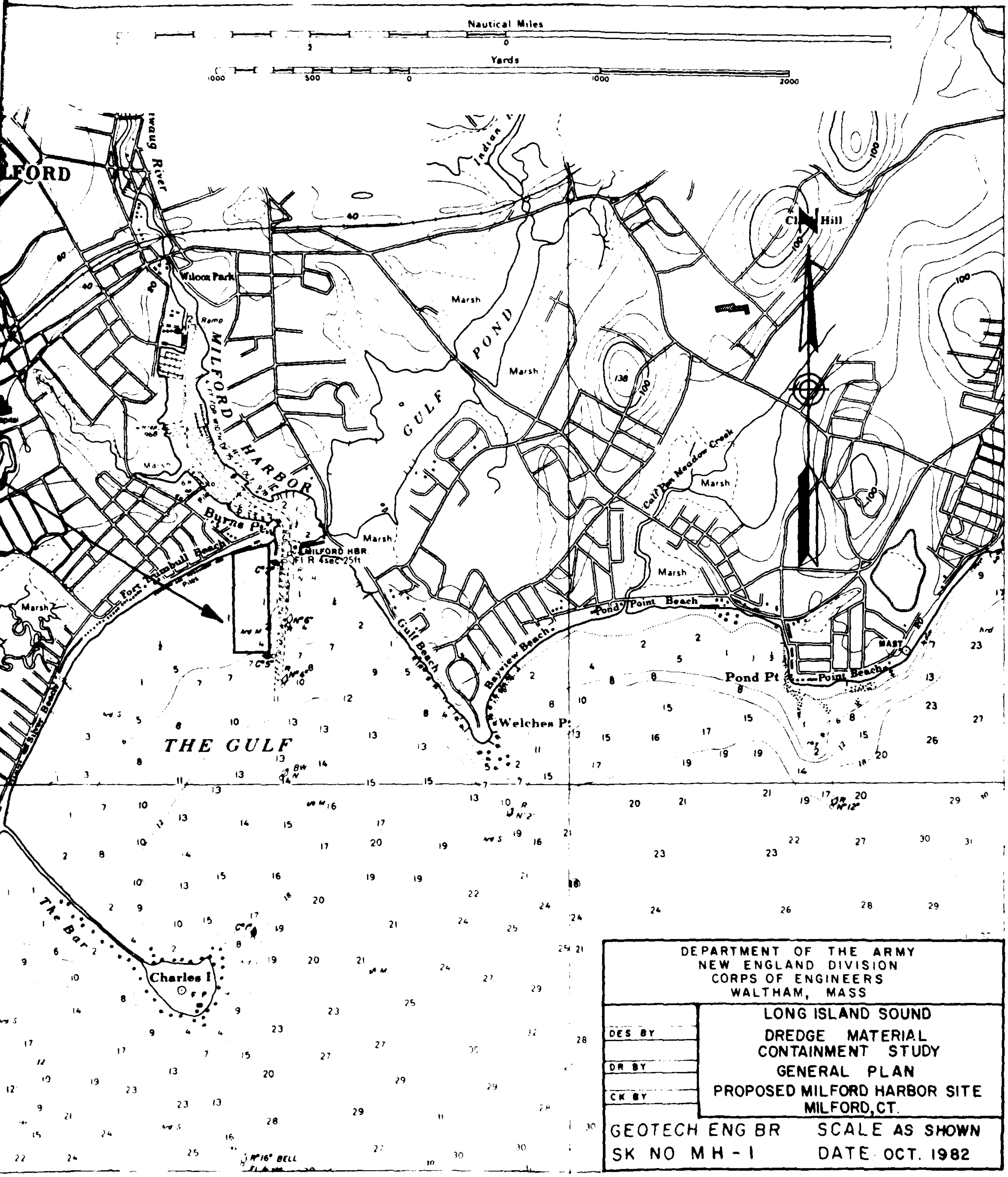
E. Brickman
DES. BY
S. W. Kelley
DR. BY
CK. BY

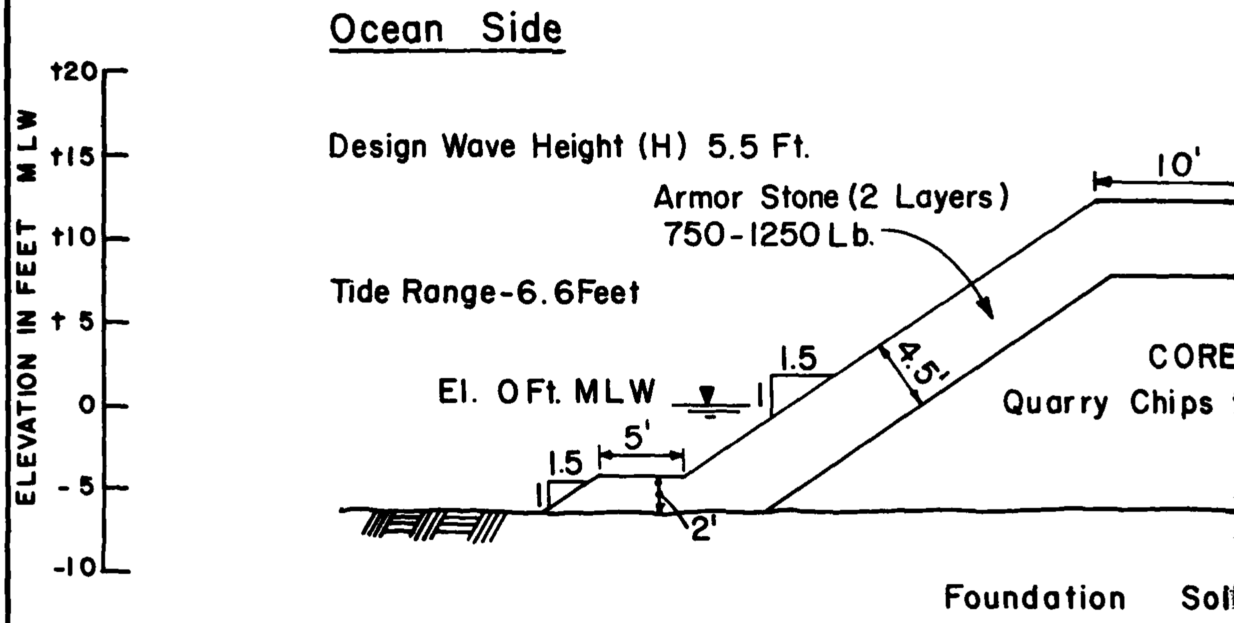
GEOTECH ENG. BR.
PLATE 2

SCALE: 1 24,000
DATE: 19 Oct 82

2


MILFORD HARBOR
PROPOSED DREDGE CONTAINMENT SITE
MILFORD
Marsh
Culver Bar
STACK (TALLEST OF SIX)
SOUTH STACK
FIXED BRIDGE HOR CL 100 FT VERT CL 65 FT
Devon
ConRail
Great Creek
Myrtle Beach
Walnut Beach
Wildermere Beach
Hospital


Nautical Miles
Yards
1000
500
0
1000
2000
FORD
River
Indian
Wilcox Park
Ramp
MILFORD HARBOR
Marsh
GULF POND
Hill
Calf Pen Meadow Creek
Burns Pt
Fort Trumbull Beach
Piles
MILFORD HBR
Fl R 4sec 25ft
Gulf Beach
Bayview Beach
Welches Pt
Pond Point Beach
Pond Pt
Point Beach
MAST
THE GULF
Silver Beach
The Bar
Charles I
BELL
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS
LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GENERAL PLAN
PROPOSED MILFORD HARBOR SITE
MILFORD, CT.
DES BY
DR BY
CK BY
GEOTECH ENG BR
SK NO MH - I
SCALE AS SHOWN
DATE OCT. 1982



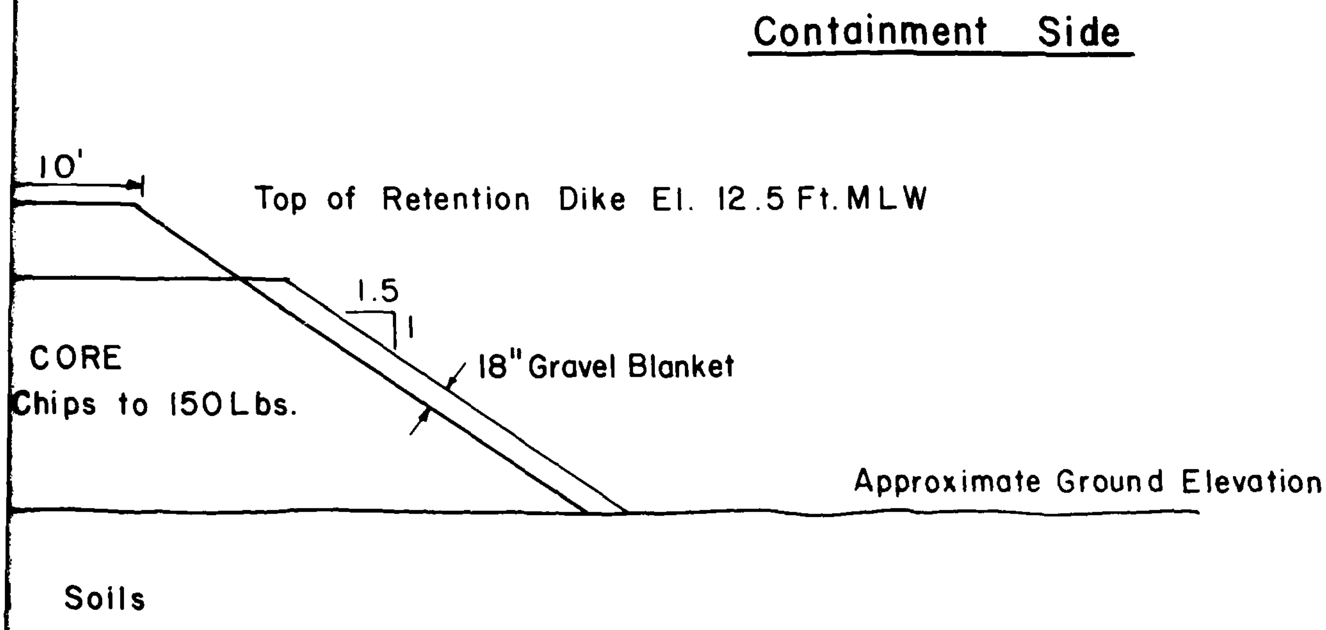
Maximum Cro

NOTES:

1) No available subsurface information. Foundation Soils assumed to be stable under proposed loadings.

2) Approximate Length of Retention Dike is 4,000 Ft. ±

3) Construction method would be end dump core material from land and graded with dozer. Armor stone would be placed from top of core with crane.



Cross - Section

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

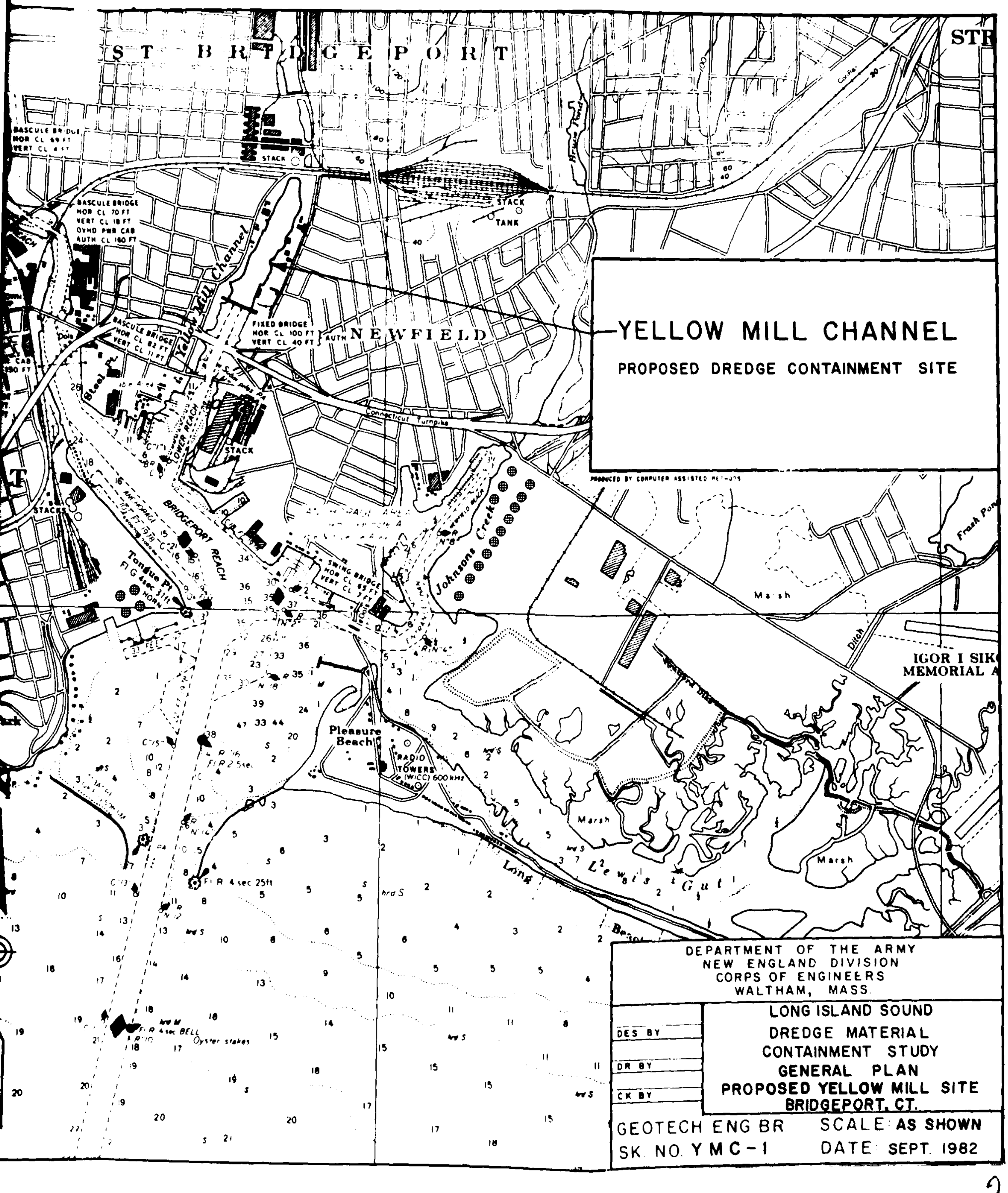
LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
TYPICAL CROSS-SECTION
PROPOSED MILFORD HARBOR SITE
MILFORD, CT.

DES BY.
DR. BY
CK. BY

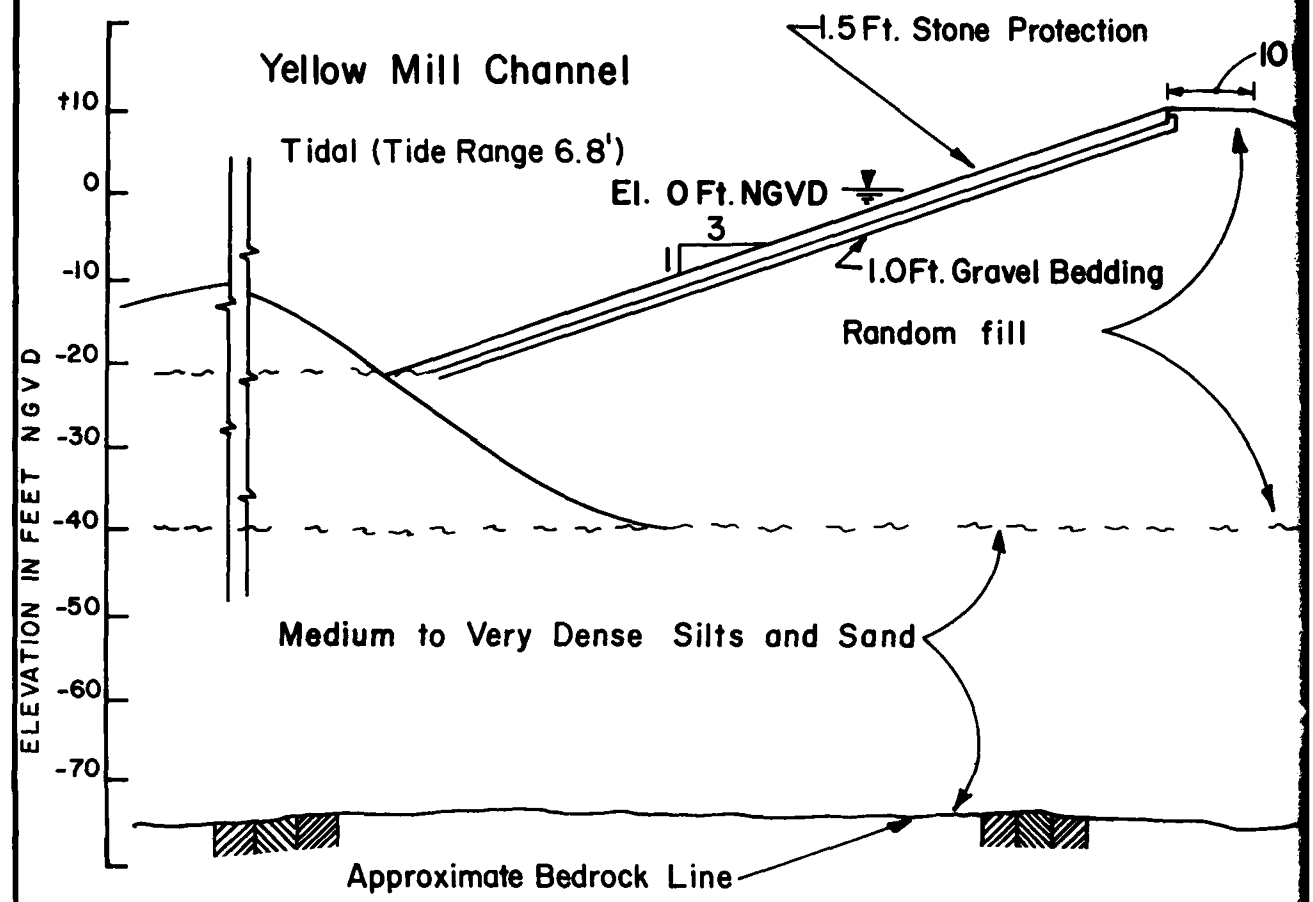
GEOTECH. ENG. BR.
SK. NO. MH - 2

SCALE: 1" = 10'
DATE: OCTOBER 1982


Nautical Miles
Yards
BASCULE BRIDGE
HOR CL 69 FT
VERT CL 4 FT
BASCULE BRIDGE
HOR CL 67 FT
VERT CL 8 FT
LOWER REACH
VERT LIFT BRIDGE
HOR CL 103 FT
VERT CL 8 FT DOWN
VERT CL 68 FT UP
TALLEST SPIRE
OVHD PWR CAB
AUTH CL 150 FT
FIXED BRIDGE
HOR CL 150 FT
VERT CL 65 FT
WHITE SPIRE
BRIDGEPORT
Hospital
STACKS
WEST BRANCH
TANK
STACK
Seaside Park
STACK
TANK
PWR CAB
COB CREEK CHANNEL
BLACK ROCK REACH
Cedar Creek
Burr Cr
Black Rock
BLACK ROCK ENTRANCE CHANNEL
Fayerweather Island
Grover Hill


YELLOW MILL CHANNEL
PROPOSED DREDGE CONTAINMENT SITE
PRODUCED BY COMPUTER ASSISTED METHODS
NEWFIELD
Yellow Mill Channel
Connecticut Turnpike
BRIDGEPORT REACH
Johnsons Creek
Pleasure Beach
RADIO TOWERS (WICC) 600 kHz
Marsh
Lewis Gut
Long
IGOR I SIK
MEMORIAL A
BASCULE BRIDGE HOR CL 69 FT VERT CL 4 FT
BASCULE BRIDGE HOR CL 70 FT VERT CL 18 FT OVHD PWR CAB AUTH CL 180 FT
BASCULE BRIDGE HOR CL 82 FT VERT CL 11 FT
FIXED BRIDGE HOR CL 100 FT VERT CL 40 FT
SWING BRIDGE HOR CL 65 FT VERT CL 7 FT
STACK
TANK
STACKS
Tongue Pt
Oyster stakes
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GENERAL PLAN
PROPOSED YELLOW MILL SITE
BRIDGEPORT, CT.
DES BY
DR BY
CK BY
GEOTECH ENG BR
SCALE: AS SHOWN
SK. NO. YMC-1
DATE: SEPT. 1982

2



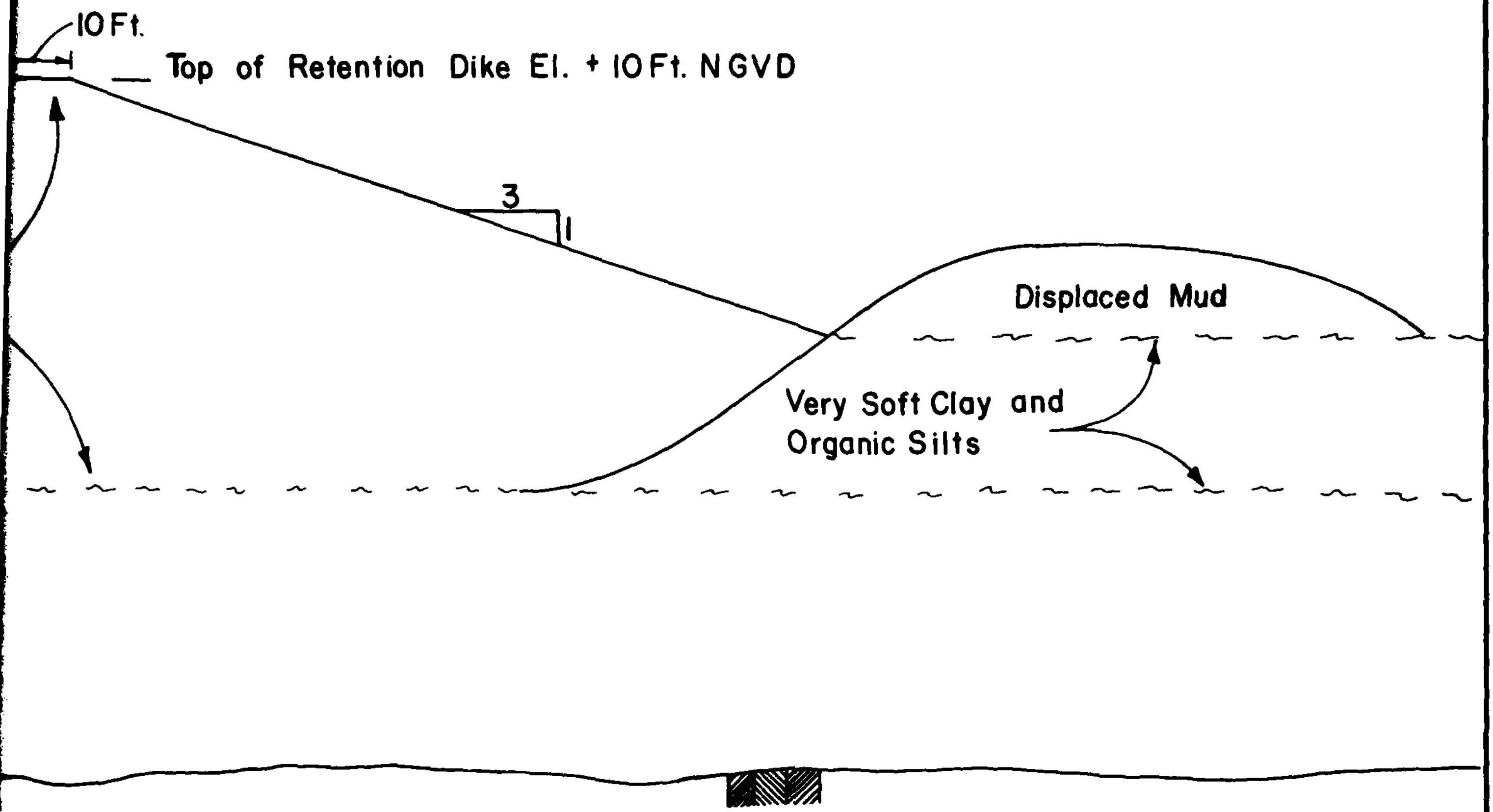
NOTES:

1) Soil information based on Connecticut State Highway Department Exploration Logs.

2) Approximate Length of Retention Dike is 500 Ft ±.

3) Construction method would be end dump and graded with dozer.

Maximum Section

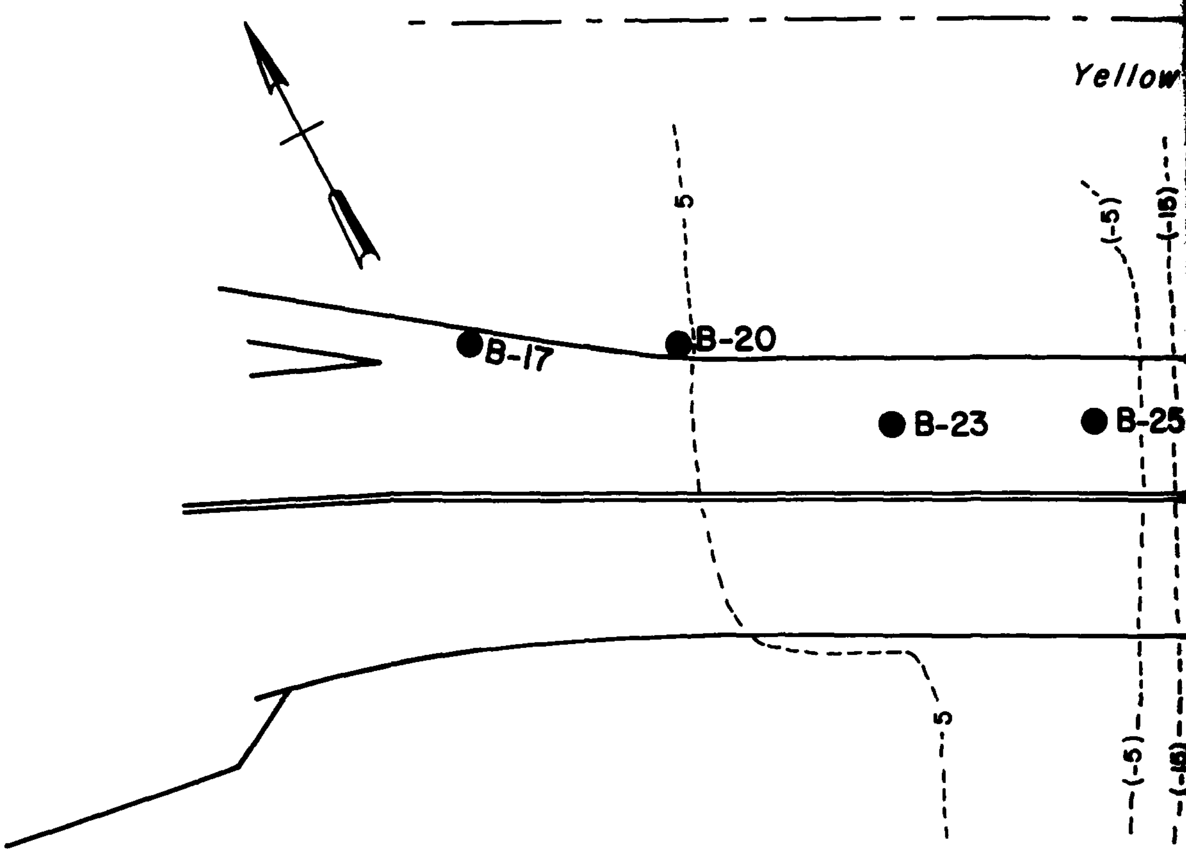


DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY J.B.
DR. BY
CK. BY

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
TYPICAL CROSS-SECTION
PROPOSED YELLOW MILL CHANNEL SITE
BRIDGEPORT, CT.

GEOTECH. ENG. BR. SCALE: 1" = 20'
SK. NO. YMC-2 DATE:



NOTES:

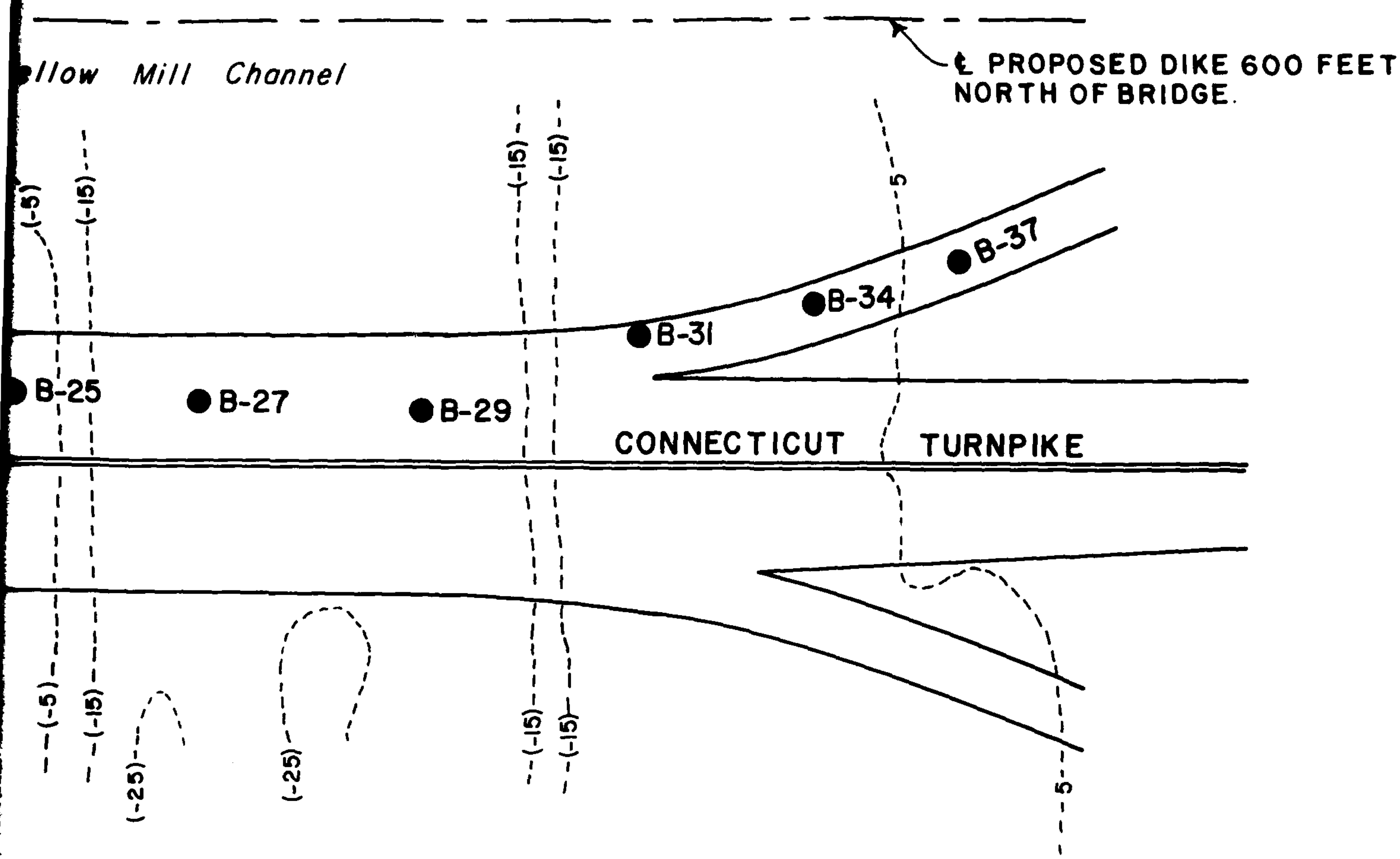
1- All information on this sheet was taken from Connecticut State Hwy. Department Plans, Greenwich-Killingly Expwy. Bridge over Yellow Mill Channel.

2- Boring logs are available from The Connecticut State Hwy Department.

● B-17 Boring location

3- Elevations are in feet M SL (Mean Sea Level).

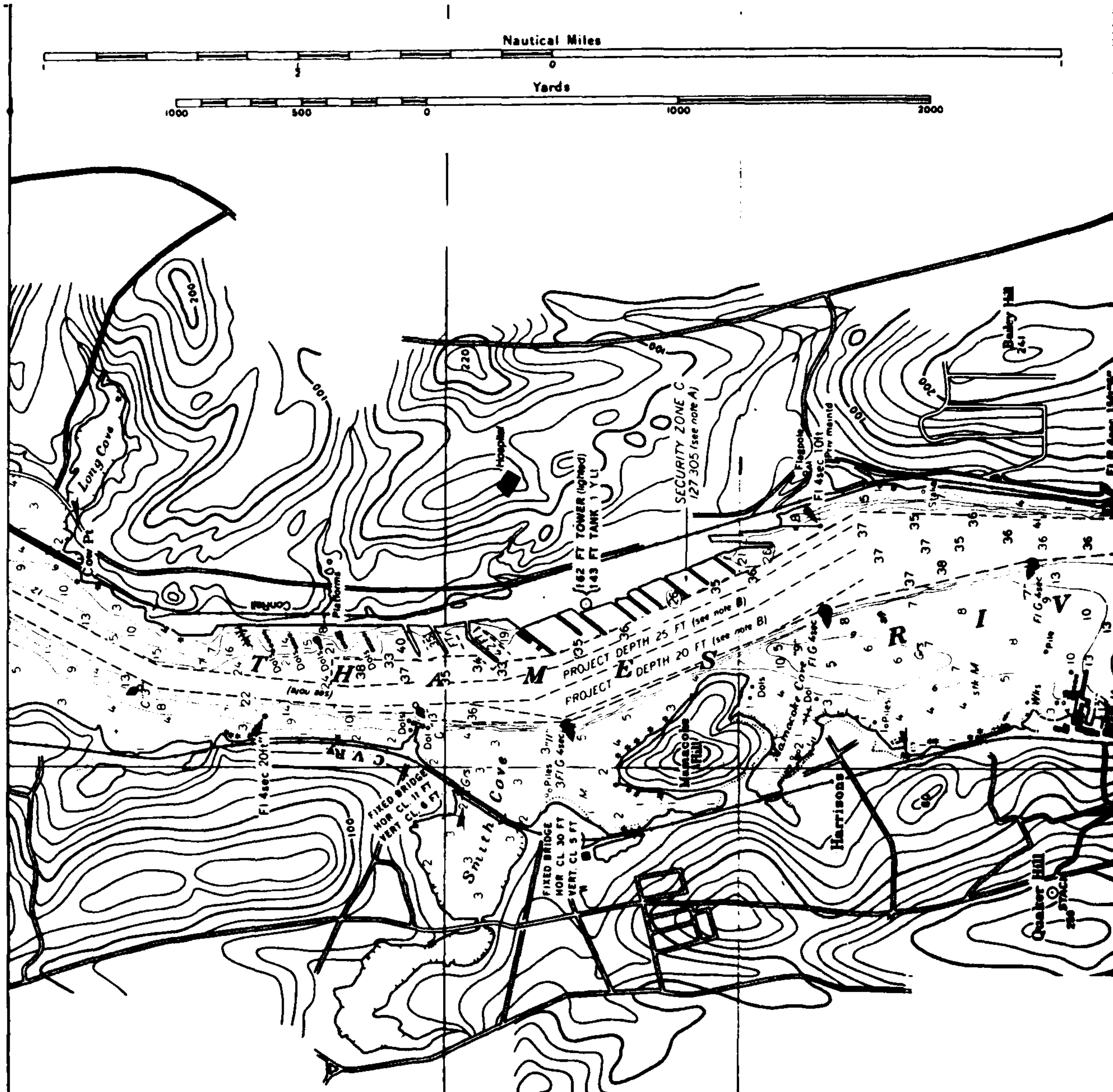
4- Sketch not to scale.



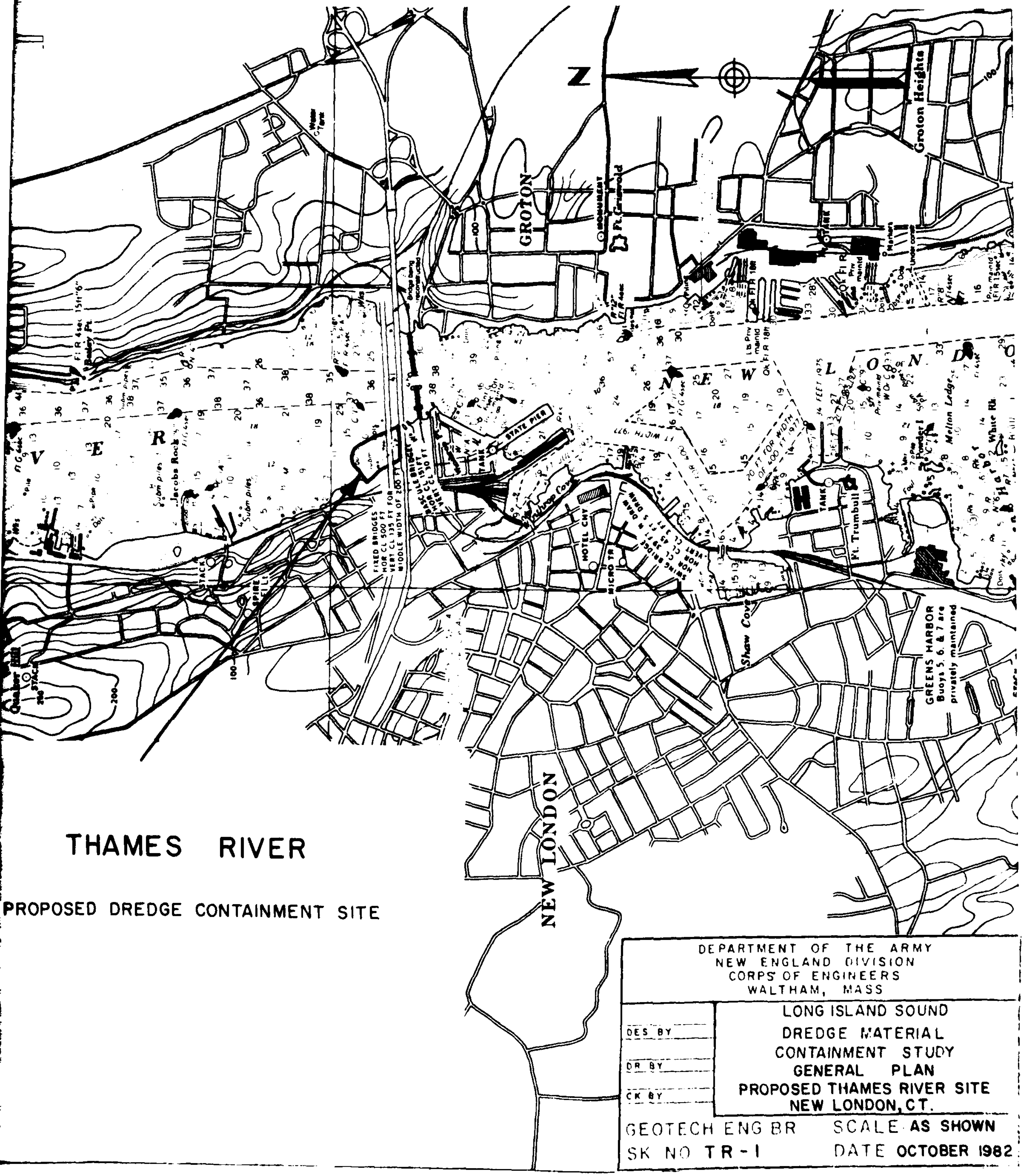
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY J.B.	LONG ISLAND SOUND
DR. BY	DREDGE MATERIAL CONTAINMENT STUDY
CK. BY	PLAN OF EXPLORATIONS (SELECTED)
	PROPOSED YELLOW MILL CHANNEL SITE
	BRIDGEPORT, CT.

GEOTECH. ENG. BR. SCALE: NOT TO SCALE
SK. NO. YMC - 3 DATE: SEPTEMBER 1982


Nautical Miles
Yards
1000
500
0
1000
2000
Long Cove
Cow Pt
Hospital
162 FT TOWER (lighted)
143 FT TANK
SECURITY ZONE C
127.305 (see note A)
Flagpole
Conrail
Platforms
PROJECT DEPTH 25 FT (see note B)
PROJECT DEPTH 20 FT (see note B)
T H A M E S
R I V E R
FIXED BRIDGE
HOR CL 11 FT
VERT CL 6 FT
FIXED BRIDGE
HOR CL 30 FT
VERT CL 5 FT
Smith Cove
Mamacoke
Mamacoke Cove
Harrisons
Quaker Hill
Bailey Hill

PROPOS



THAMES RIVER

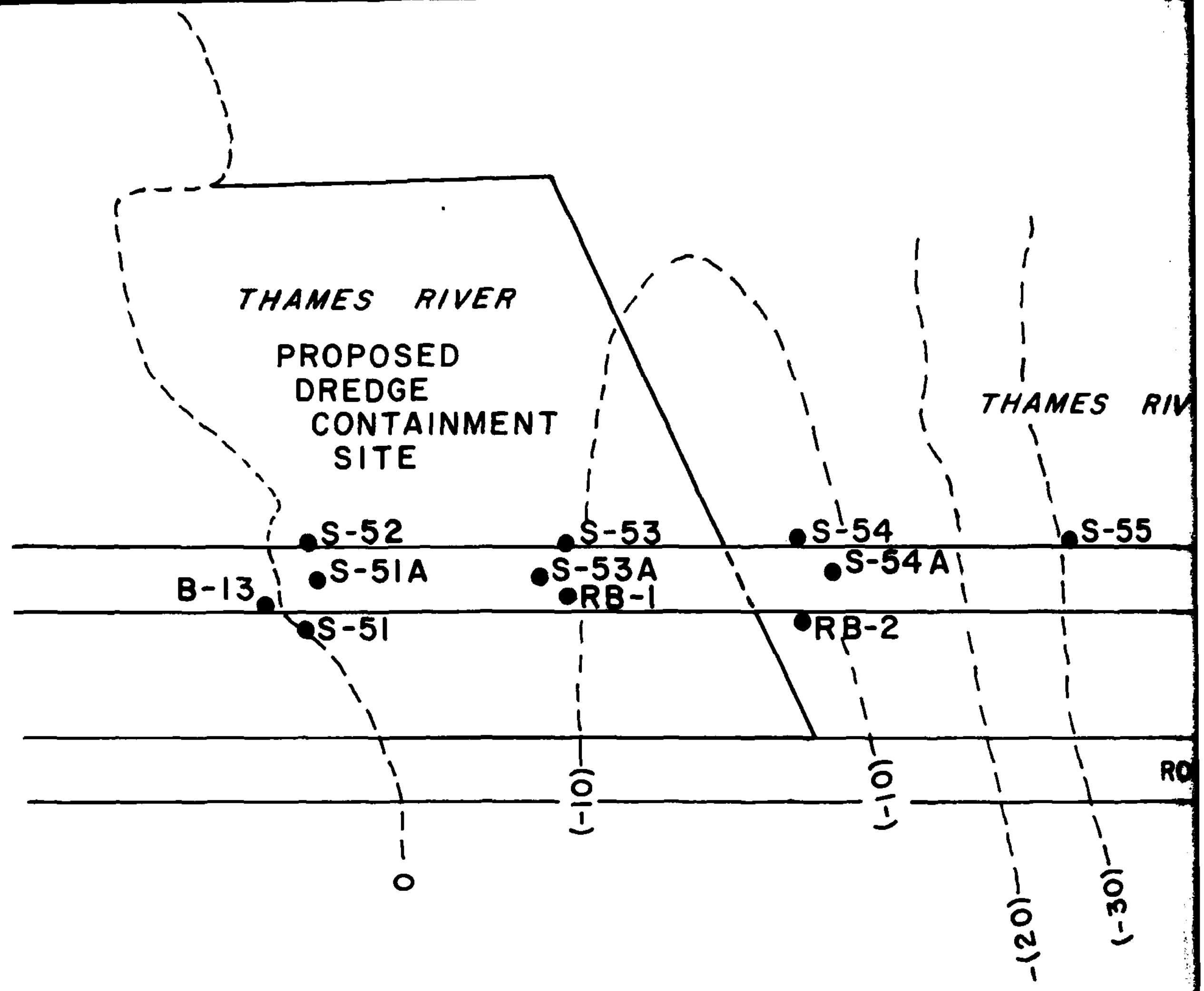
PROPOSED DREDGE CONTAINMENT SITE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

DES BY	LONG ISLAND SOUND DREDGE MATERIAL CONTAINMENT STUDY GENERAL PLAN PROPOSED THAMES RIVER SITE NEW LONDON, CT.
DR BY	
CK BY	

GEOTECH ENG BR — SCALE AS SHOWN

SK NO TR-1 — DATE OCTOBER 1982



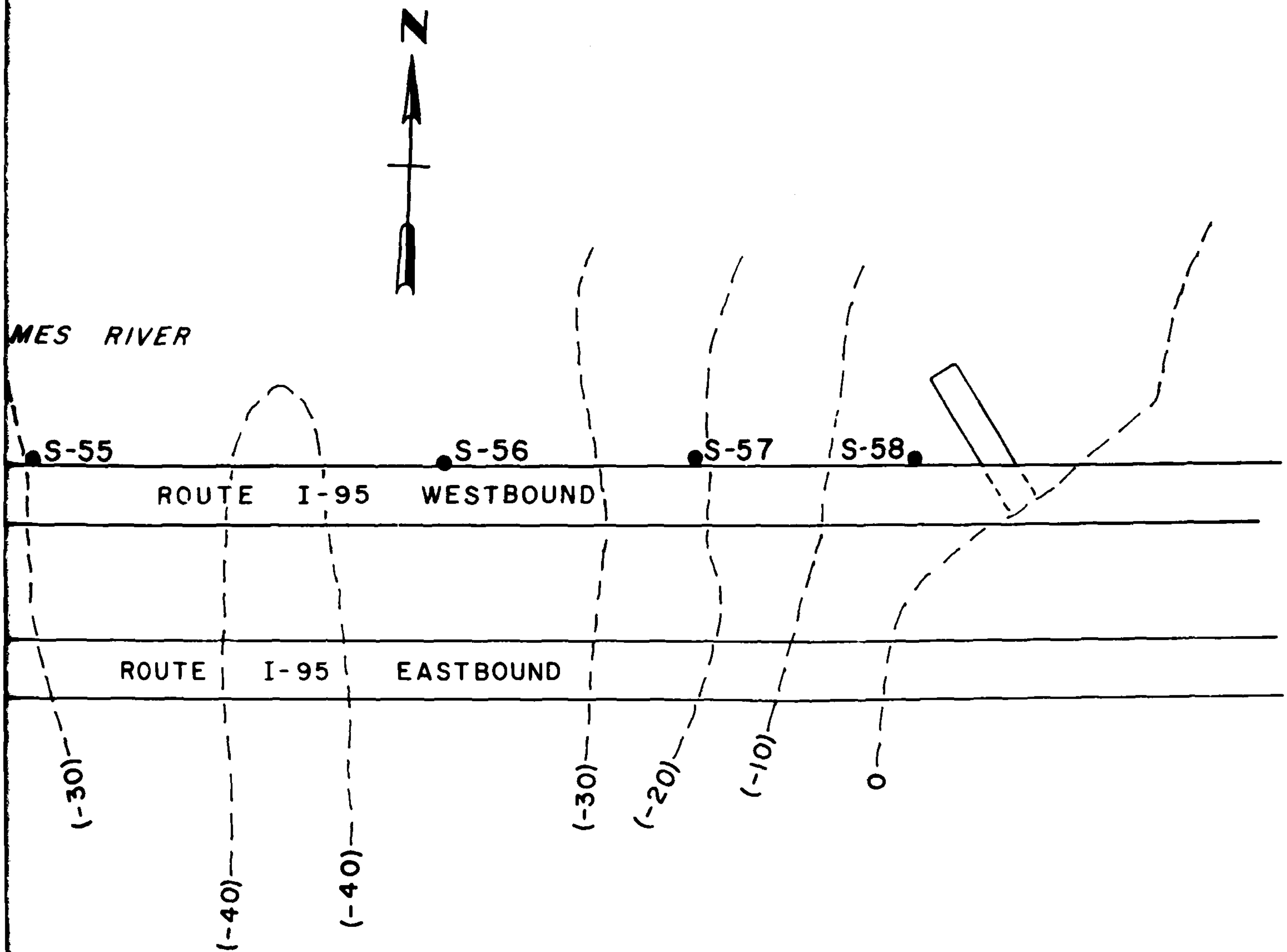
NOTES

1 All information on this sheet was taken from Connecticut State Hwy. Department Plans, "Thames River Bridge - Interstate 95 Westbound"

2 Boring Logs are available from Connecticut State Hwy. Dept.
● S-53 Boring location.

3 Approximate Elevations are in feet MSL (Mean Sea Level).

4 Sketch not to scale.



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

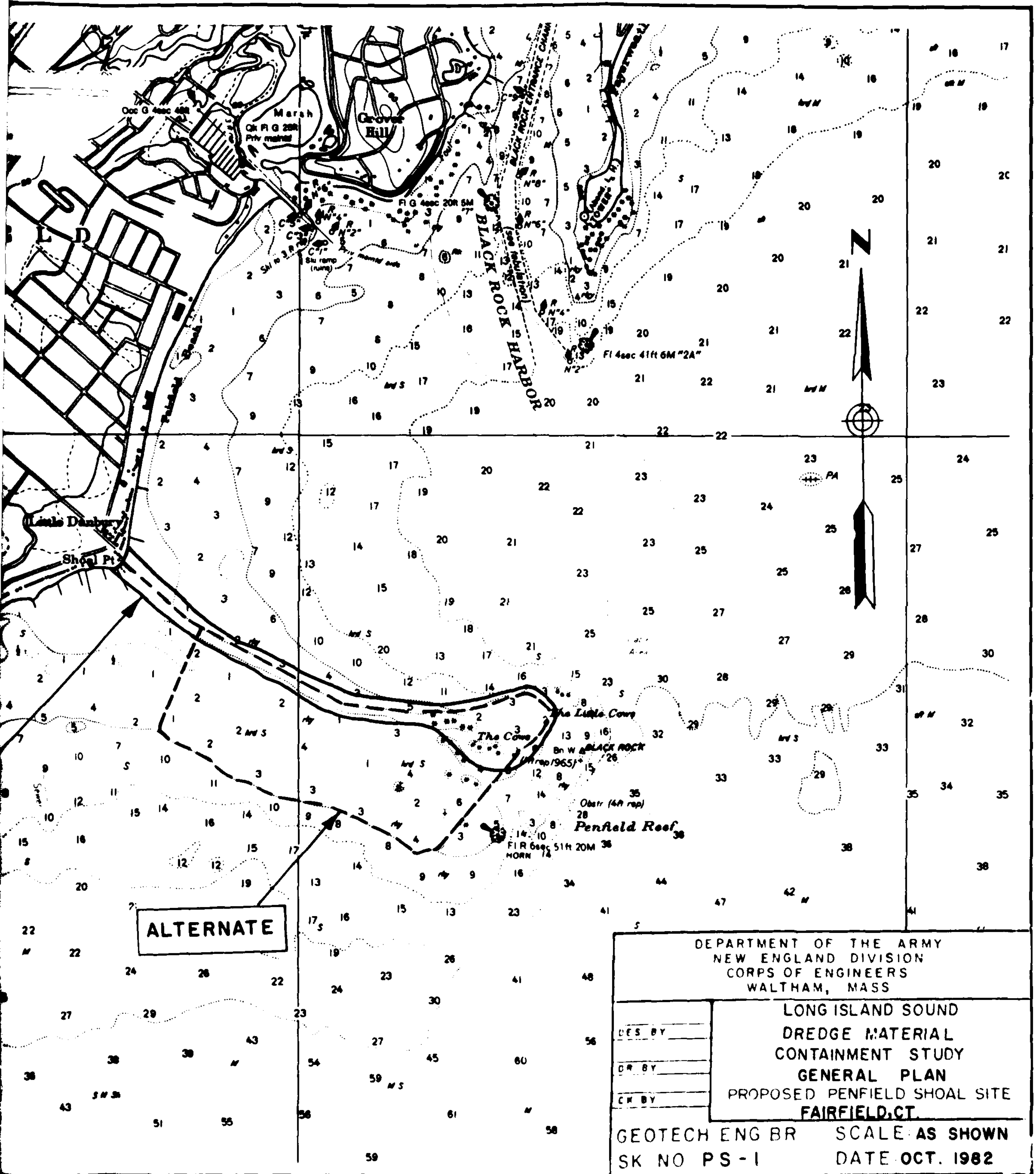
LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
PLAN OF EXPLORATIONS(SELECTED)
PROPOSED THAMES RIVER SITE
NEW LONDON, CT.

DES. BY J. P.
DR. BY
CK. BY

GEOTECH. ENG. BR. SCALE: NOT TO SCALE
SK. NO. TR-2 DATE: OCTOBER 1982

PENFIELD SHOAL

PROPOSED DREDGE CONTAINMENT SITE
WITH ALTERNATE



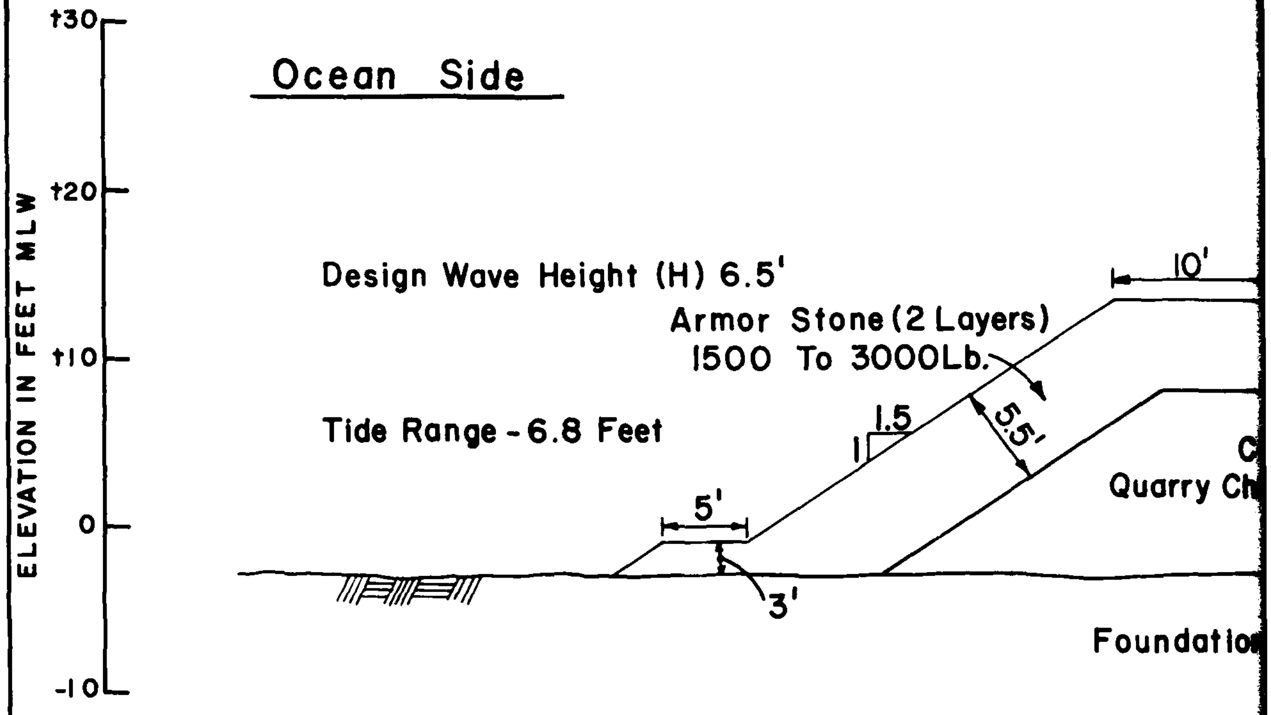
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS

LONG ISLAND SOUND
DREDGE MATERIAL
CONTAINMENT STUDY
GENERAL PLAN
PROPOSED PENFIELD SHOAL SITE
FAIRFIELD, CT.

DES BY
DR BY
CK BY

GEOTECH ENG BR
SK NO PS-1
SCALE AS SHOWN
DATE OCT. 1982

2



Typical Cr

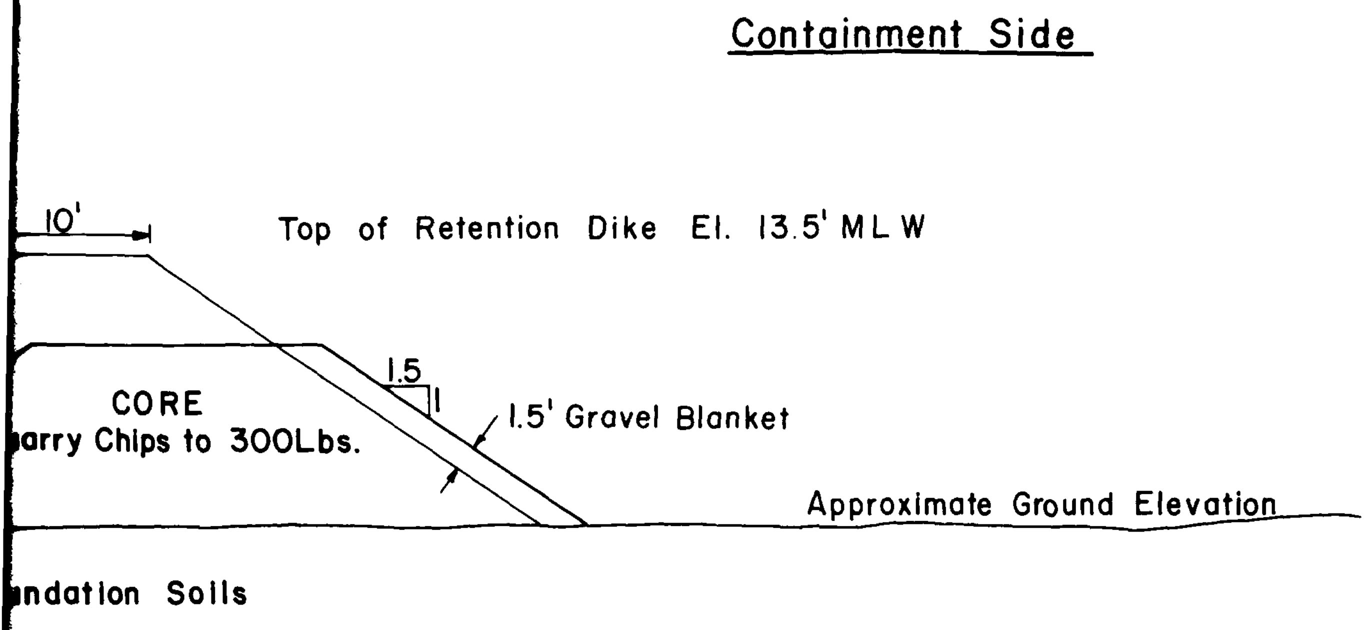
NOTES:

1) No available subsurface information. Foundation Soils assumed to be stable under proposed loadings.

2) Approximate Length of Retention Dike is 15,000 Ft. ±, 16,000 Ft. ± Alternate Alignment.

3) Construction method would be end-dump core material from land and graded with dozer. Armor stone would be placed from top of core with crane.

4) Design wave height for the southern side of the structure is 5.0 Ft.



l Cross - Section

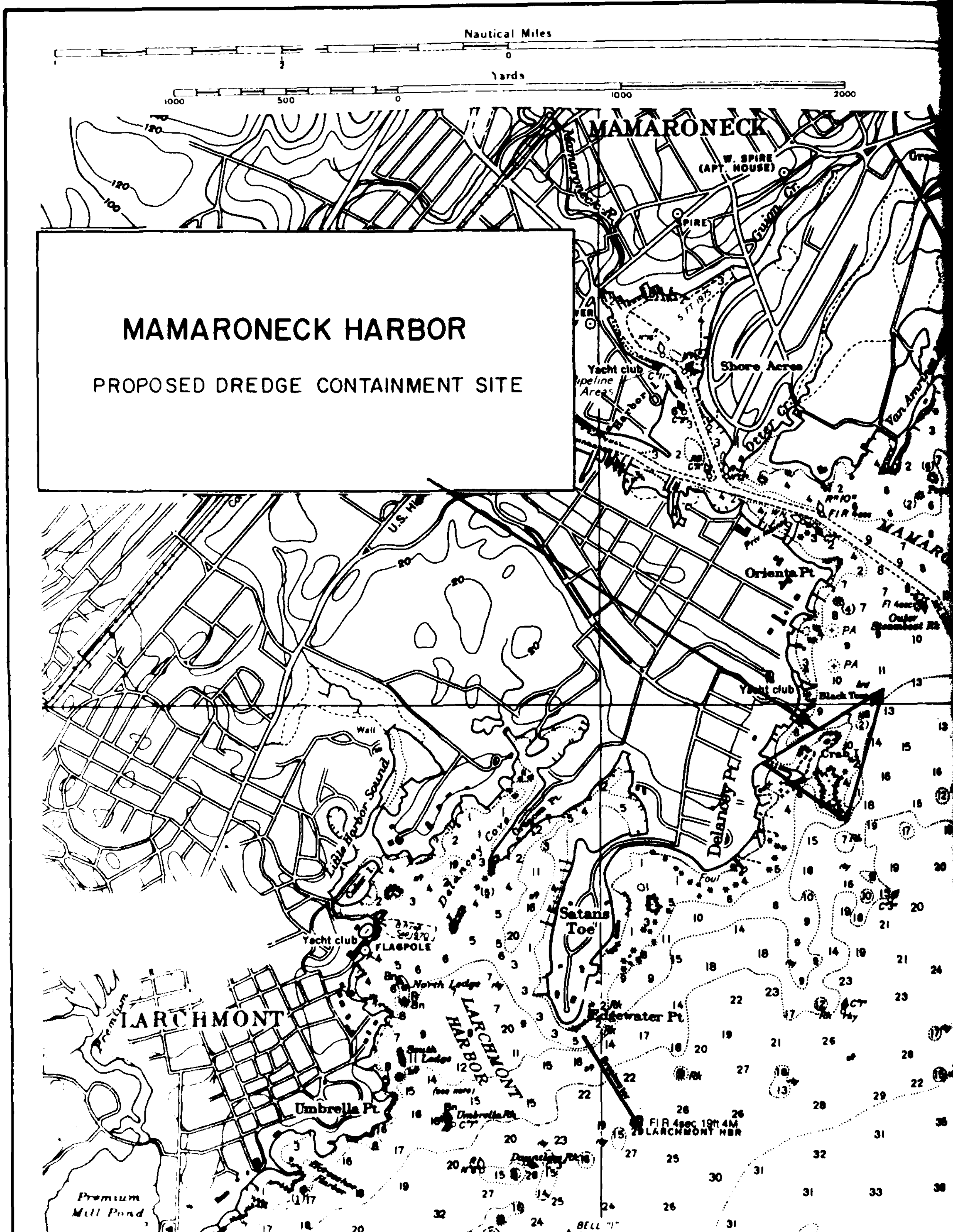
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

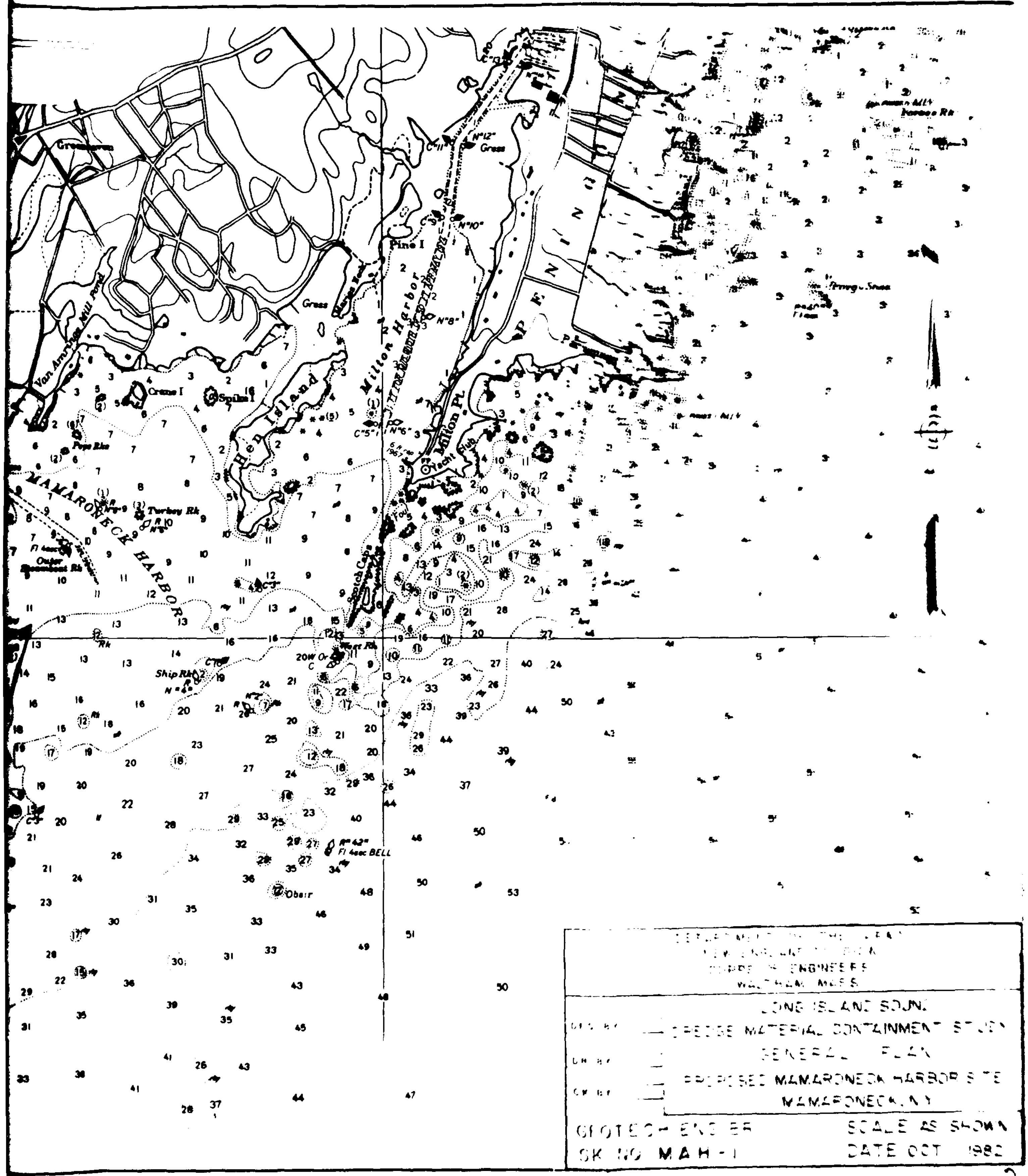
DES BY.
DR BY
CK.BY

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
TYPICAL CROSS-SECTION
PROPOSED PENFIELD SHOAL SITE
FAIRFIELD, CT.

GEOTECH. ENG. BR. SCALE: 1" = 10'
SK. NO. PS - 2 DATE: OCTOBER 1982

2


MAMARONECK HARBOR
PROPOSED DREDGE CONTAINMENT SITE
Nautical Miles
Yards
1000
500
0
1000
2000
MAMARONECK
W. SPIRE (APT. HOUSE)
Shore Acres
Yacht club
Orienta Pt
Yacht club
Black Tom
Delancey Pt
Delancey Cove
Little Harbor Sound
Satans Toe
Yacht club
FLAGPOLE
North Ledge
LARCHMONT HARBOR
LARCHMONT
Edgewater Pt
South Ledge
Umbrella Pt
Umbrella Rk
Premium Mill Pond
Oak I
FI R 4sec 19ft 4M LARCHMONT HBR
BELL "1" Fl 4sec



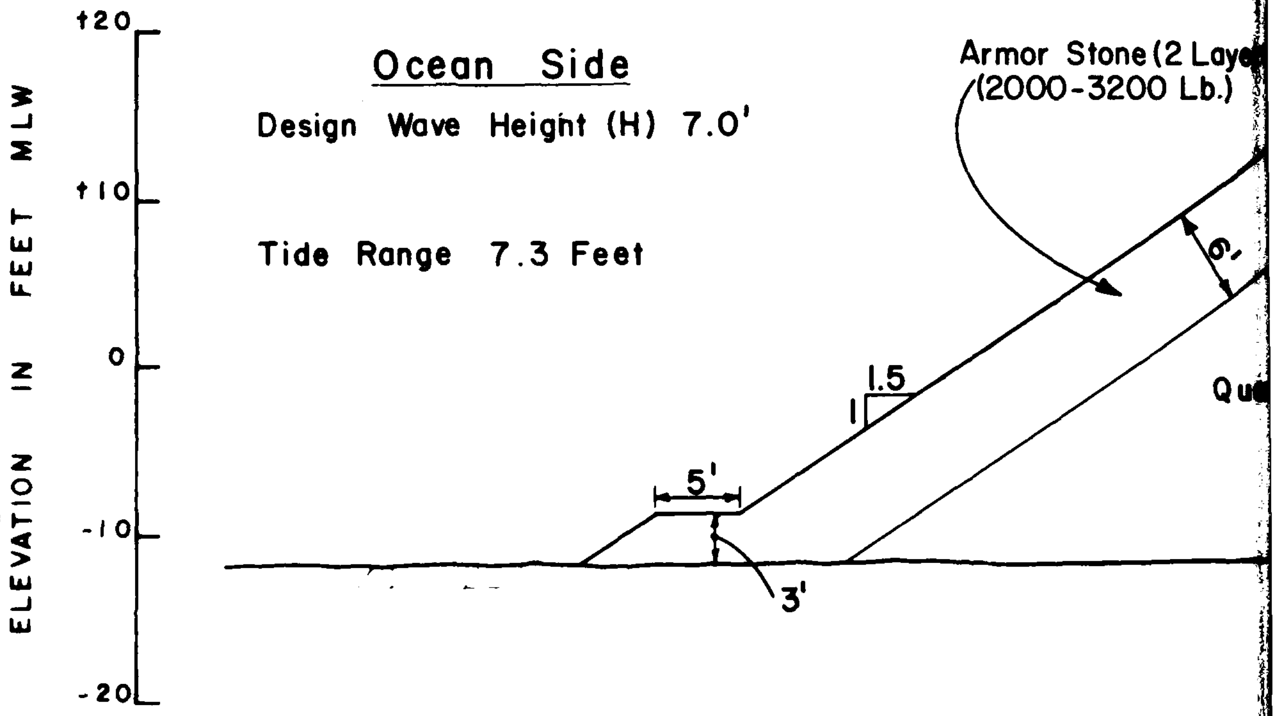
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
GENERAL PLAN
PROPOSED MAMARONECK HARBOR SITE
MAMARONECK, N.Y.

DES. BY
DR. BY
CK. BY

GEOTECH. ENGINEER
SK. NO. MAH-1

SCALE AS SHOWN
DATE OCT. 1982



Maximum

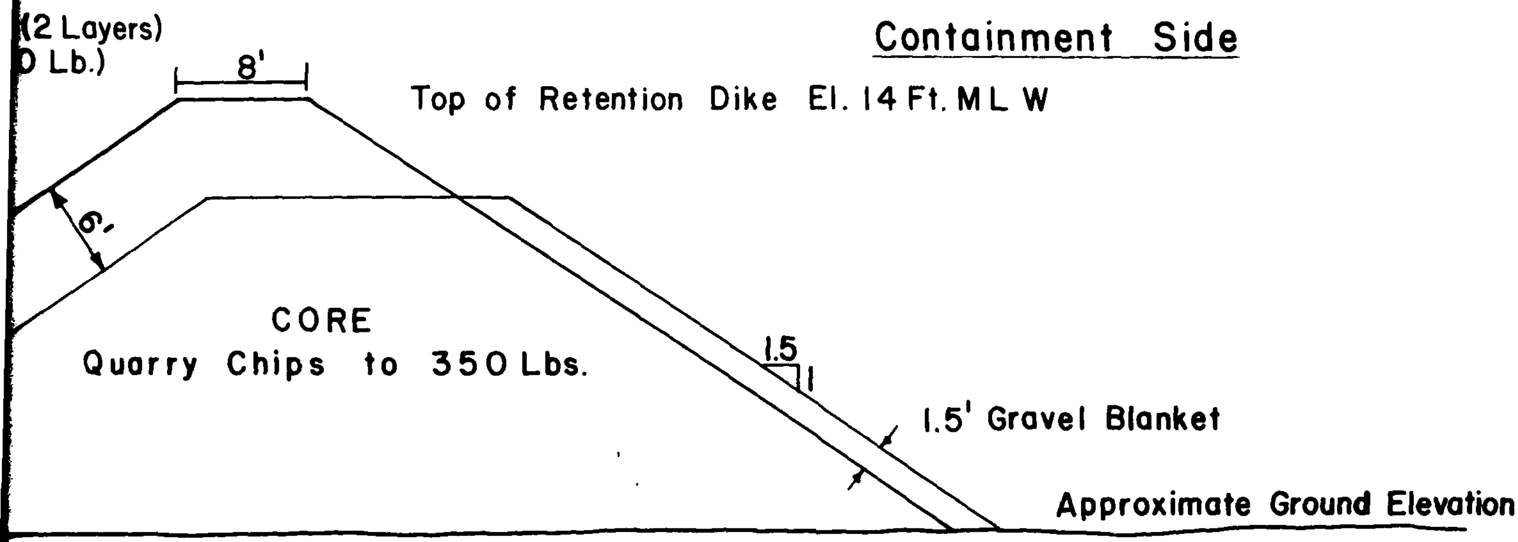
NOTES:

1) No available subsurface information. Foundation Soils assumed to be stable under proposed loadings.

2) Approximate Length of Retention Dike is 5,000 Ft. ±

3) Construction method would be end-dump core material from land and grade with dozer. Armor stone would be placed from top of core with crane.

4) Design wave height for the Northern Side of the structure is 3.0 Ft. and 5.0 Ft. for the West Side.



mum Cross - Section

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

LONG ISLAND SOUND
DREDGE MATERIAL CONTAINMENT STUDY
TYPICAL CROSS-SECTION
PROPOSED MAMARONECK HARBOR SITE
MAMARONECK, N.Y.

DES. BY.
DR. BY.
CK. BY.

GEOTECH. ENG. BR. SCALE: 1" = 10'
SK. NO. MAH - 2 DATE: OCTOBER 1982

END

DATE
FILMED

6 - 83

DTIC